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Pamphlet No. 1

GERMAN SHELLS, FUZES AND BOMBS

By Command of the Army Council,

THE WAR OFFICE,
6th November, 1940.

WAR

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SHELLS

BOMBS

1. Percussion fuze LWMZ.23

All dimensions are in mm. unless otherwise stated.

FIG. 1

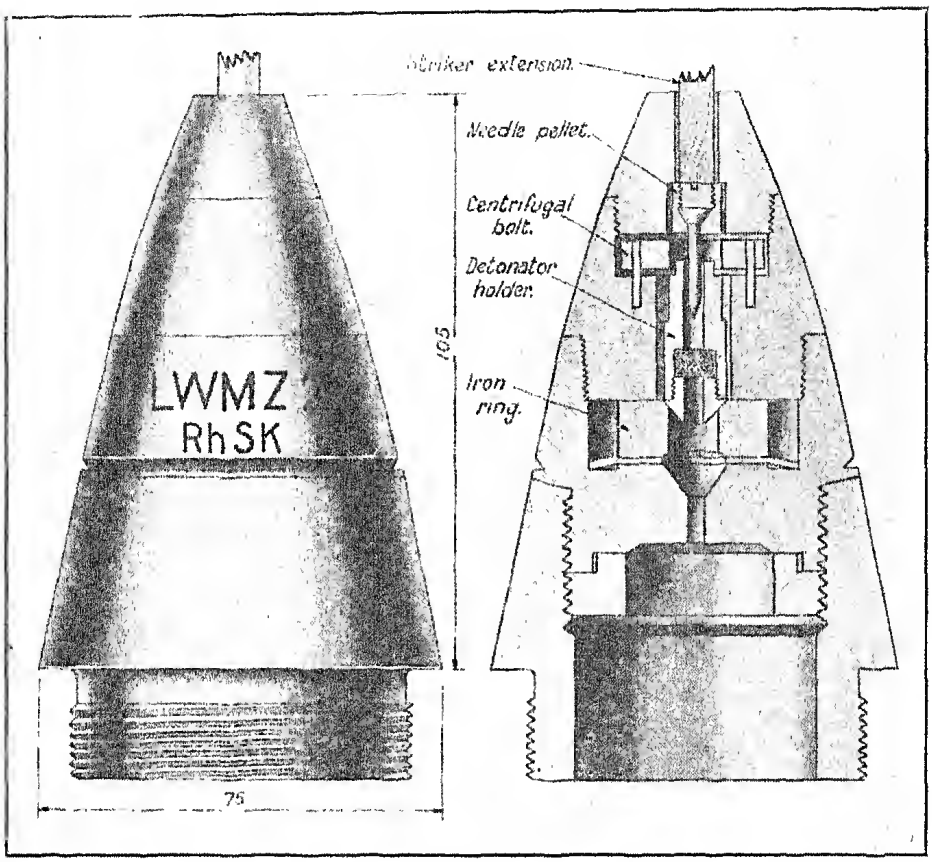


FIG. 1.

This is a direct action fuze in bronze, without delay, actuated by the forcing back, on impact, of a wooden striker extension. Safety is ensured by the arrangement of centrifugally operated safety bolts (*see* description of percussion fuze AZ.23 Rh.S. (0·25)) and the detonator holder is supported on an iron ring as in percussion fuze JGRZ.23.r.A. (0·15).

The marking of the fuze shows that it is used for a light trench mortar bomb and judging by the dimensions of the ogive into which this fuze is screwed the bomb would be of approximately 7·5 cm. calibre.

2. Fuze for shells of small calibre AZ.150 Rh.S.

FIG. 2

This is an extra sensitive fuze with an explosive safety device, armed centrifugally. It is used in shell for 2 cm. aircraft and A.A. guns.

It consists of a fuze body of brass on which is screwed a nose retained by a screw. The body is prepared to take a percussion detonator.

The percussion system consists of:—

(*a*) A striker kept in a safe position by a centrifugal bolt which fits under a flange below the head of the striker;

(*b*) a hammer with an enlarged head to increase the sensitivity of the fuze;

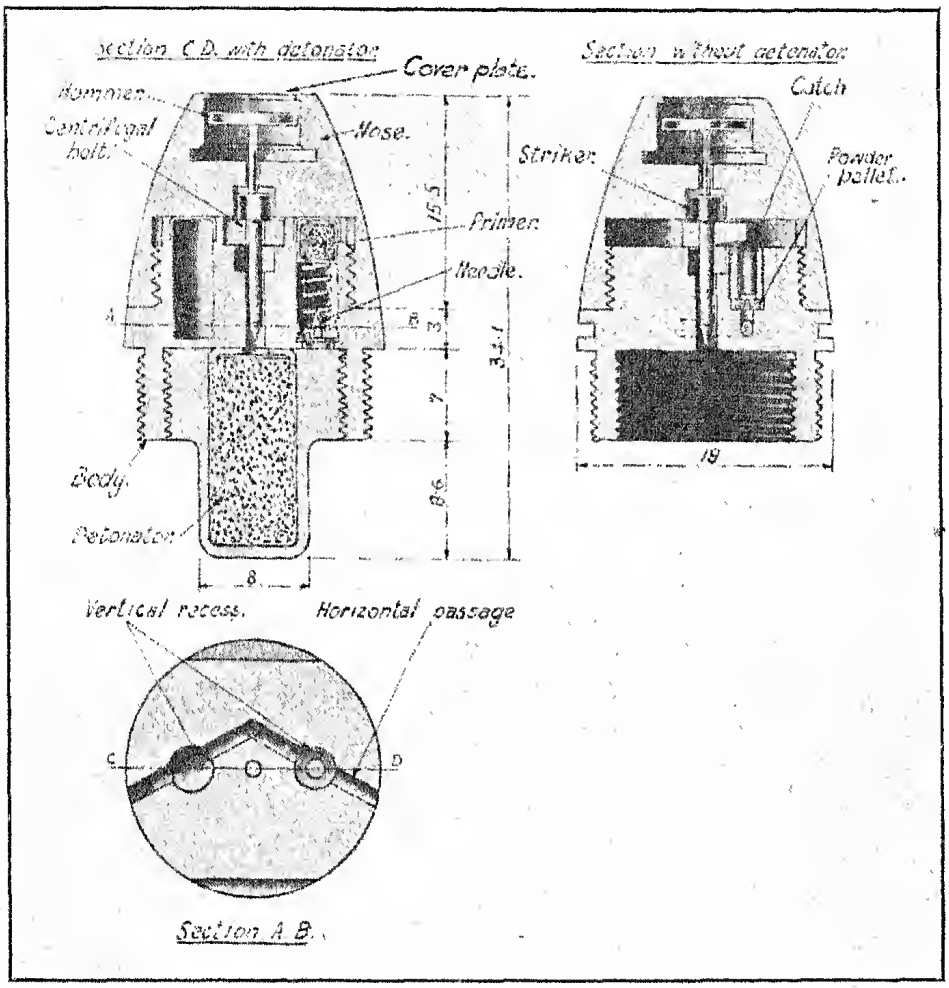


FIG. 2.

(*c*) a safety arrangement consisting of a catch supported on a pellet of compressed gunpowder. The catch is held with its top rounded bearing surface against the inclined plane of the centrifugal bolt and thus prevents this from moving outwards.

The powder pellet is connected, through two cylindrical horizontal passages, to two vertical recesses, one of which contains a primer supported over a needle by a spring the other identical but empty in the fuze examined.

Action.—On firing the primer sets back on the needle and is ignited. The flash passes through the horizontal passage and ignites the powder pellet. When the pellet is fuzed it frees the catch and thus allows the centrifugal bolt to fly outwards. The striker is then free but creep action due to deceleration in flight and the protection of the cover plate keeps it from the detonator until it is driven in on impact.

3. Skoda percussion fuze (with or without delay)

FIGS. 3 AND 4

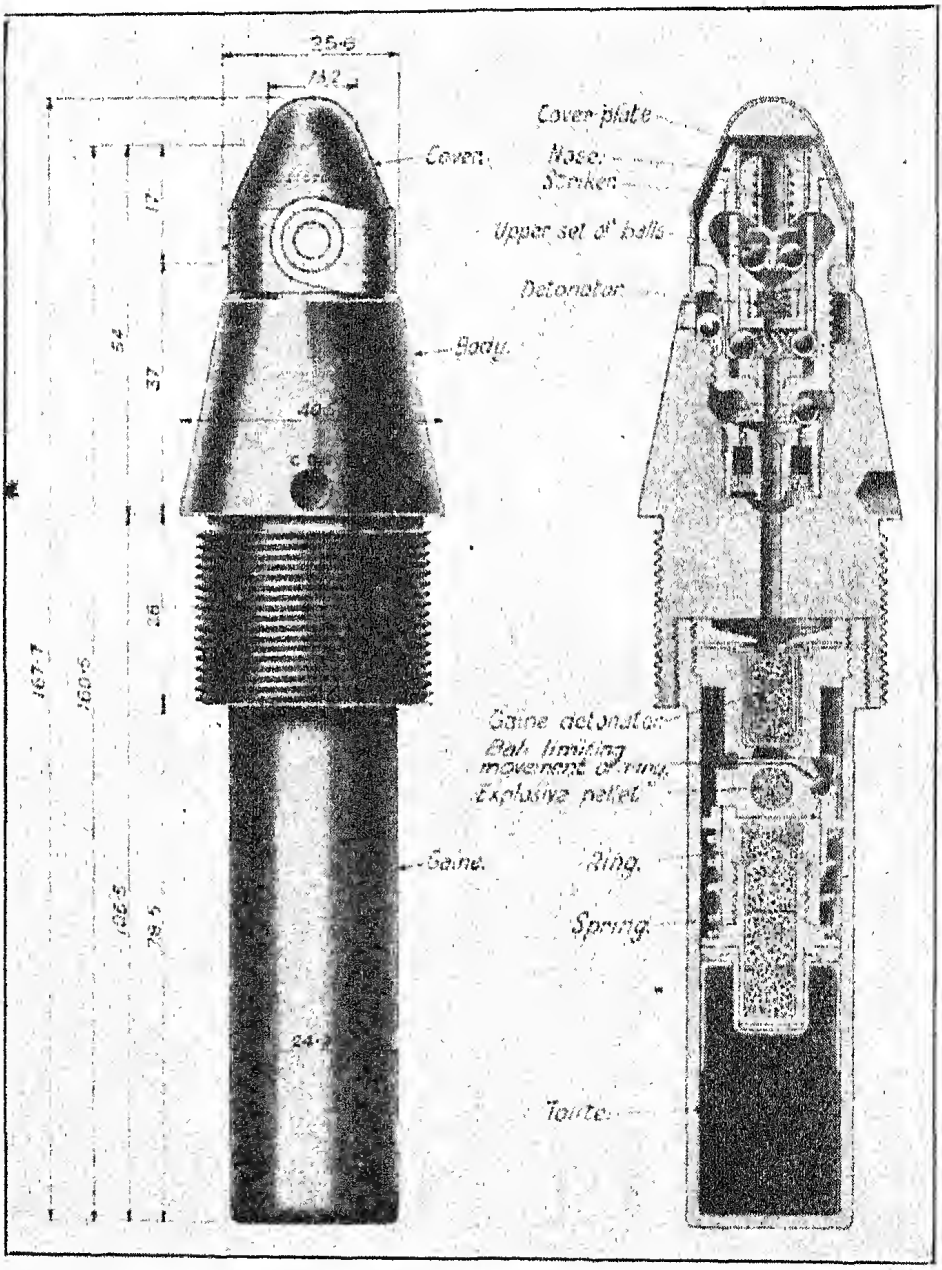


FIG. 3.

This fuze was found in a 100 mm. shell. Fragments of this type of fuze were also found with splinters which appear to be from 75 mm., 83·5 mm. and possibly 150 mm. shells.

The fuze fragments examined carry the Skoda markings as shown in Skoda drawings in the possession of the Schneider Works where the fuze is known as the SKHZR. Skoda drawings show that this fuze can be used for shell varying from 75 mm. to 210 mm. calibre.

Description.

The principal parts of the fuze are :—

(*a*) Body, (*b*) percussion mechanism, (*c*) setting device for delay or instantaneous, (*d*) the gaine.

(*a*) The conical steel body is fitted with a brass nose which can be screwed in or out of the body and forms the means of setting the fuze for instantaneous or delay action. The lower part of the body is threaded to take the gaine and the upper part hollowed, screw threaded and sealed with solder. Externally the body is given a protective coating (nature not specified) and fitted with a brass cover, soldered on, which is removed before firing.

(*b*) The striker is of nickel steel with a head of duralumin screwed on to it. It is protected by a bronze cover plate set into the nose of the fuze and retained with sealing putty. The striker is prevented from striking the detonator before impact by :—

(1) Four polished nickel steel balls which fit between the striker and the detonator holder ;
(2) a creep spring which keeps the striker away from the detonator during flight ;
(3) four castellated notches formed by cutting and bending the top end of a small tube of sheet iron through which the striker passes.

The detonator is secured in the detonator holder by a screwed plug and is contained in a copper tube. It consists of equal parts by weight of fulminate of mercury and inflammable composition. A transverse hole is drilled through the detonator holder to form a seating for the spiral spring which holds the lower set of balls in the circular run in the body.

The detonator holder is seated in a brass tube which has at its lower end two semi-circular notches which retain the lower set of balls in position before firing. The upper part of the tube has three equidistant rectangular notches through which the upper set of balls pass by centrifugal force after firing and two lateral grooves in which the lower set of balls are forced when the brass tube sets backs on firing.

(*c*) The delay holder contains two parallel delay fillings of amorphous powder and compressed powder. These are retained in position by a brass plate. The holder has a central fire channel which, when the nose of the fuze is unscrewed, is closed by a ball.

To set for instantaneous action (Fig. 3).

The nose is screwed into the body and its lower portion, being coned, displaces the ball from the central channel. The flash from

the detonator can then pass direct through the continuous central channel of the fuze.

To set for delay (Fig. 4).

The nose is unscrewed and the ball, due to gravity, closes the central channel. The flash from the detonator can then only pass through the transverse channels in the base of the nose and so through the delay fillings to the gaine.

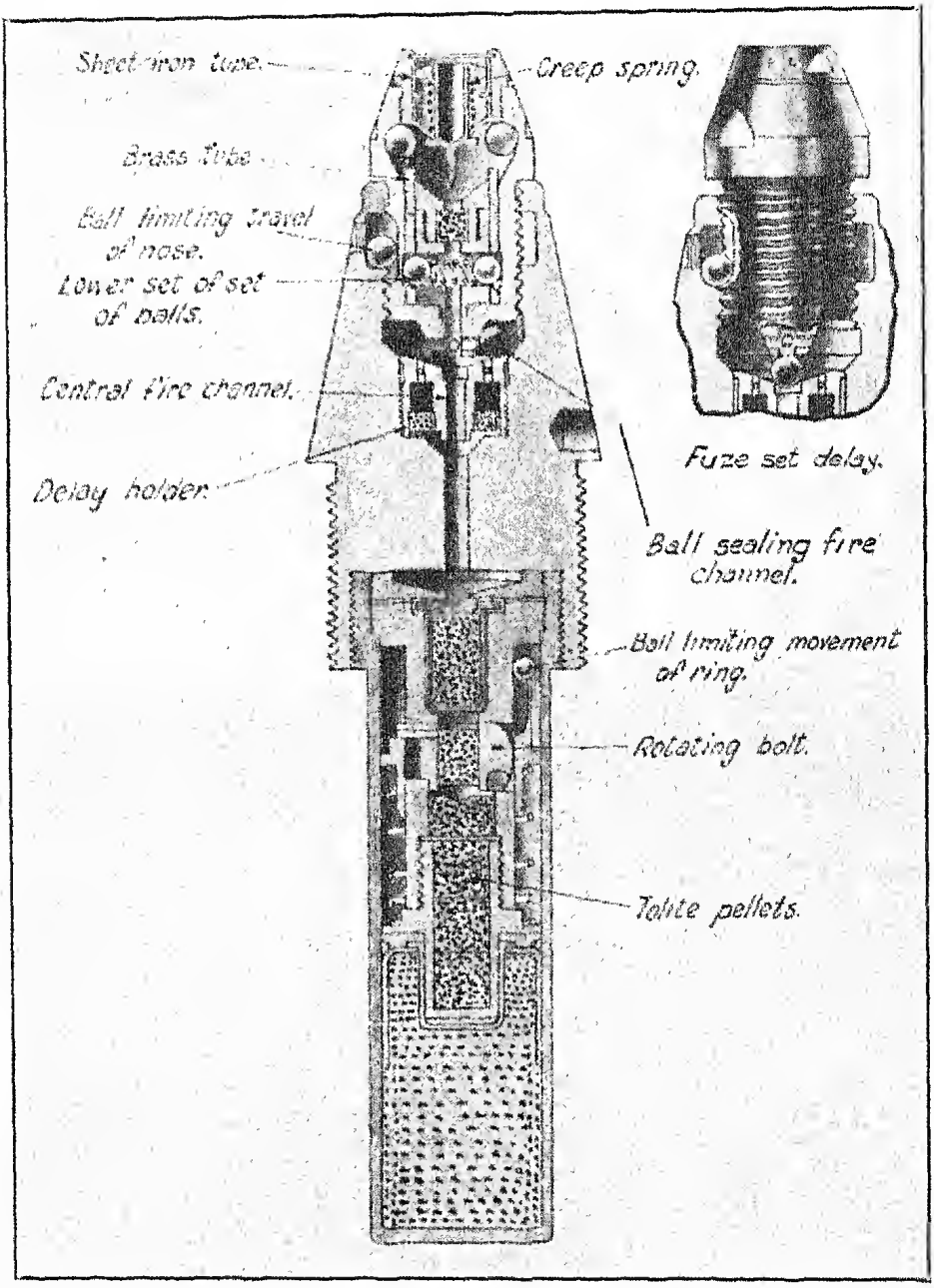


FIG. 4.

After unscrewing and with the ball closing the central channel, the nose of the fuze must then be screwed in again in order to seal hermetically the junction of the ball and channel and to prevent the ball from moving outwards due to centrifugal action in flight.

The amount of unscrewing is limited by a ball which is carried in a seating in the body and is free to move in a groove cut in the threaded portion of the nose.

(*d*) The gaine, of steel, varnished black, is screwed into the lower part of the fuze. It consists of a detonator, exploder and safety devices.

The detonator consists of fulminate of mercury and compressed Tolite grains carried in a holder and retained by a washer.

The exploders consist of Tolite pellets in varying degrees of compression and are held in a brass tube. The bottom of the gaine is filled with a larger charge of Tolite.

The safety device (Fig. 4) consists of a rotating bolt containing an explosive pellet. The normal position of the bolt is at right angles to the axis of the fuze where it is retained by a ring held in position by a spiral spring. A ball limits the upward movement of the ring. In this position the explosive pellet in the bolt is at right angles to the axis of the fuze, there is, therefore, no communication between the detonator and the exploders.

On firing the ring sets back, compressing its spring. The ball, which is designed to prevent the upward movement of the ring, is now free to move outwards under centrifugal force.

On deceleration, after the shell has left the bore, the ring is forced forwards by its spring and this movement rotates the bolt through 90 degrees. The pellet in the bolt is then in line with the axis of the fuze and completes the transmission of the detonation to the exploders.

Action of fuze.

On firing, the brass tube which retains the lower set of balls in position, sets back. The balls are thrust into the hole of the detonator holder, pass along the grooves and return to the circular runway. Centrifugal force causes the upper set of balls to pass one after the other through the upper notches of the brass tube and come to rest in the runway of the fuze body. Allowing the balls to escape one at a time is an added safety device against prematures.

During flight the striker is kept from the detonator by the creep spring and by the notches cut in the sheet iron tube in the nose. The detonator holder is held by the lower set of balls bearing in the circular runway.

On impact the striker is forced inwards, stripping the notches of the tube and compressing the creep spring. The detonator holder slides through the brass tube overcoming the resistance of the lower set of balls and is carried on to the striker.

4. German percussion fuze, AZ.23.Rh.S. (0·25)

The German percussion fuze AZ.23.Rh.S. with ·25 seconds delay (Fig. 5) is used in the 105 mm. howitzer and probably also in 75 mm. separate ammunition. It is designed to function on impact or graze.

The fuze consists chiefly of a body, needle and needle pellet, centrifugal bolts with spring, detonator pellet with detonator, creep spring, delay mechanism and magazine.

The body, of aluminium, is in two parts, screwed together and secured by a set screw. The upper part has a central channel throughout its length to receive the needle, which is secured in

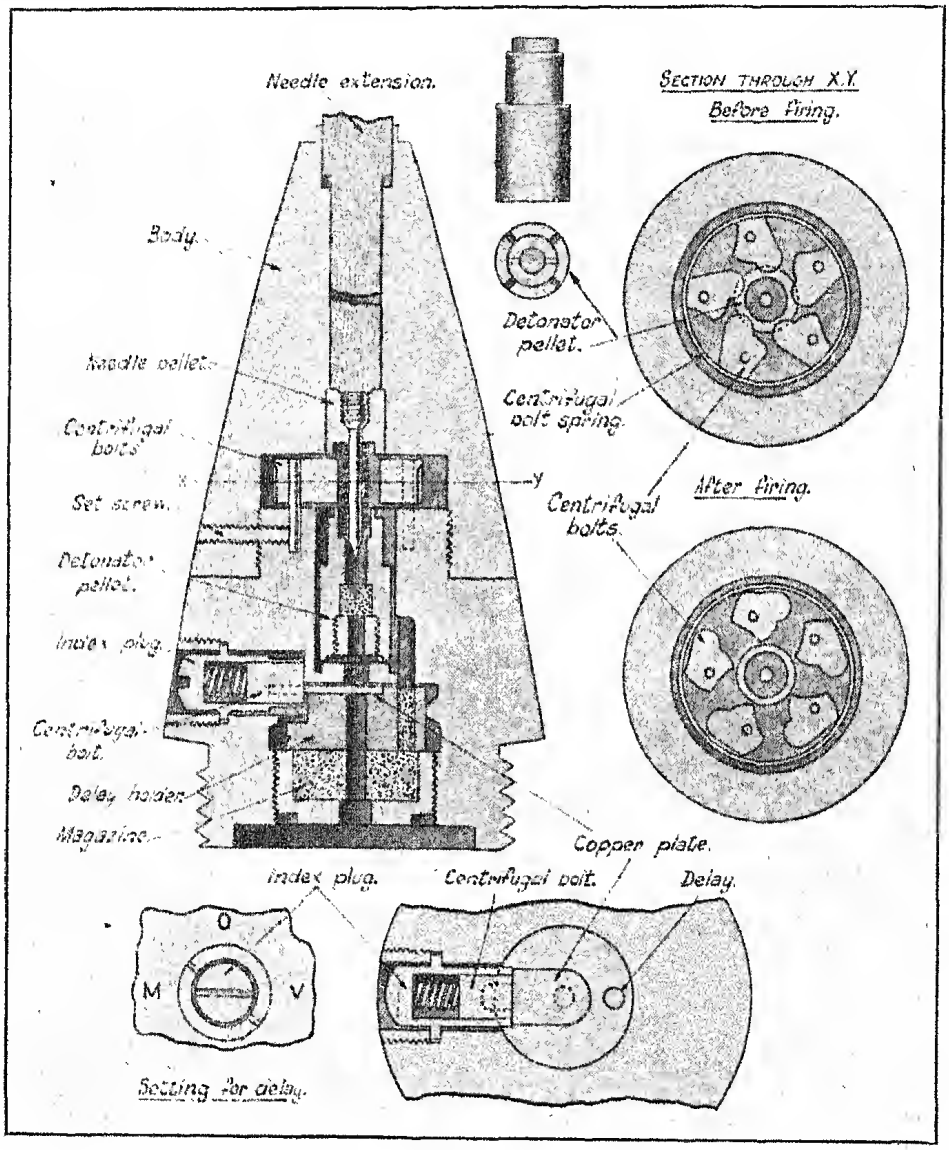


FIG. 5.

the aluminium needle pellet by a securing screw. The needle is fitted with a wooden extension. On the underside of the needle pellet, the central channel is enlarged to house five brass centrifugal bolts, each with its pivot pin. The bolts are kept pressed towards the centre of the fuze by means of a phosphor bronze spring, which

maintains the bolts in such a position that when the fuze is at rest, the needle cannot pierce the detonator.

The lower part of the body contains a brass detonator pellet and detonator, the delay mechanism and a magazine. The detonator is secured in the pellet by a screw having a central fire channel. Four radial slots are cut on the underside of the pellet to ensure that the flash from the detonator reaches the delay channel.

The delay mechanism consists chiefly of a delay holder, index plug with centrifugal bolt and spring, and a copper plate. The holder is pierced by two channels, one central and empty, the other eccentric and carrying the delay. On the upper portion of the holder a recess is cut in which a copper plate can slide. According to its position this plate covers or uncovers the central channel.

The index plug is secured in the body of the fuze by a screwed collar. A cylindrical cavity is formed in the plug to receive the centrifugal bolt with spring and a recess is cut in the plug to receive the copper plate. On the outside of the plug a slot is cut which serves as an index for setting the delay mechanism. If the plug is set in the delay position, the recess does not coincide with the plate, the latter therefore remains in the closed position masking the central fire channel. If the fuze is set to the instantaneous position (Fig. 6) the recess is in line with the plate and the latter is free to move outwards under centrifugal force and so unmask the central fire channel. A brass plate with holes bored to correspond with the delay and central channel is placed on the delay holder and forms an upper bearing surface for the copper plate.

The bottom of the fuze is closed by the magazine, having a central fire channel, which is screwed in and retains in position the delay holder.

Action.

Before firing (Fig. 5).—The needle is separated from the detonator by the centrifugal bolts which are retained in the closed position by their spring. The copper plate of the delay mechanism closes the central fire channel by the pressure from the centrifugal bolt. This position is maintained whether the fuze is set delay or instantaneous. The delay channel is always uncovered.

Thus, even if a failure of the safety arrangements occur and the needle pierces the detonator or the detonator itself fires, the fuze can only function with delay; the shell, therefore, cannot burst at less than ·25 second's time of flight from the muzzle.

To set the fuze for instantaneous action the slot in the index plug is turned to a position parallel to the axis of the fuze bringing the recess in the plug opposite the copper plate (Fig. 6). For delay action the slot is turned at right angles to the fuze axis opposite the marks M. and V.; in this position the plug retains the copper plate in the closed position (Fig. 5).

After firing.—The centrifugal bolts swing outwards overcoming the spring thus leaving the needle and detonator pellets free to move towards each other. The creep spring prevents creep action. The centrifugal bolt of the delay mechanism moves outward compressing its spring. If the index plug is in the delay position, the copper plate is held by the plug and thus the central channel remains closed (Fig. 5). If the plug is in the instantaneous position, the

plate is moved by centrifugal force into the slot in the plug and the central channel is thus opened (Fig. 6).

On impact the needle is forced on to the detonator by direct action. On graze the detonator pellet is carried forward on to the needle. The flash from the detonator passes either through the delay channel or the central channel, according to the setting of the fuze, to the magazine and thence to the detonator and exploder in the shell.

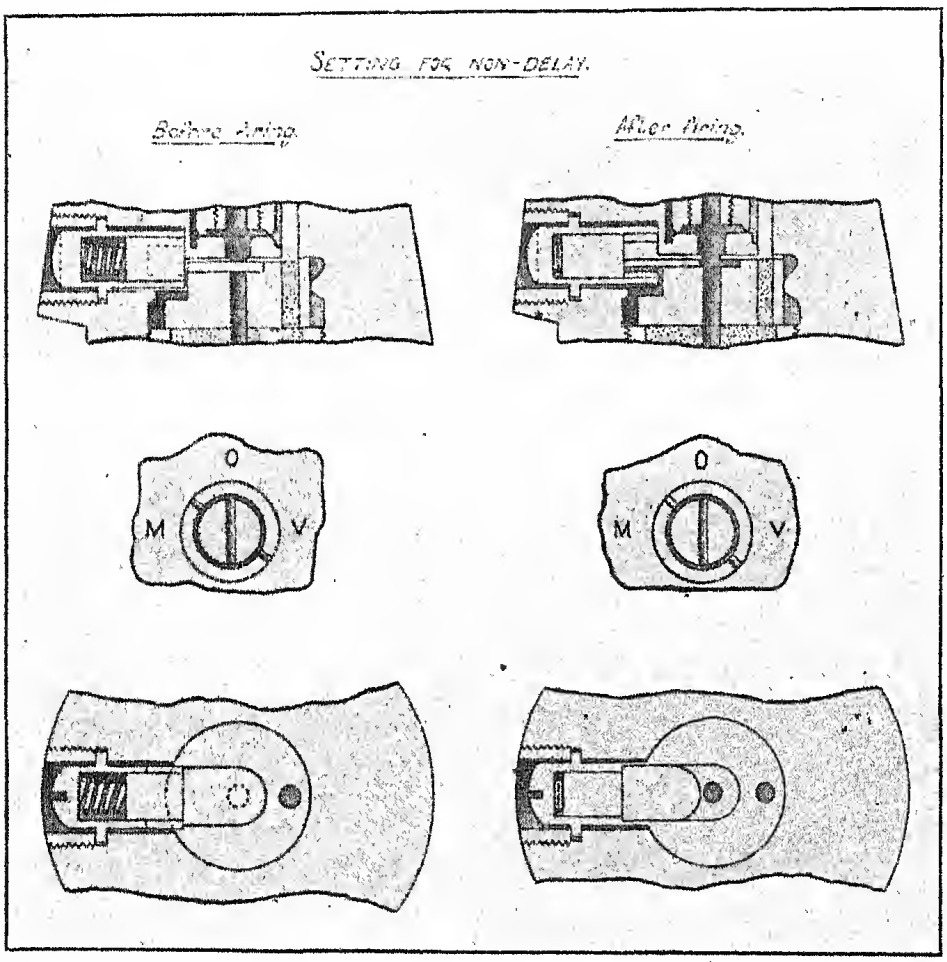


FIG. 6.

Other fuzes operated on the above principle are :—

(*a*) J.Gr.Z.23.n.A. used with 75 mm. separate ammunition and possibly 105 mm.

(*b*) A.Z. 23 (0·8) umg. used with 150 mm.

(*c*) AZ.23.M. (2V.) used with 150 mm.

The only difference between the above types is in the system controlling the delay.

5. Percussion, fuze J.Gr.Z.23n.A. (0·15)

FIG. 7

This aluminium fuze has so far only been found in 7·5 cm. separate ammunition.

In appearance it is similar to Fuze AZ.23 R.h.S. (0·25) previously

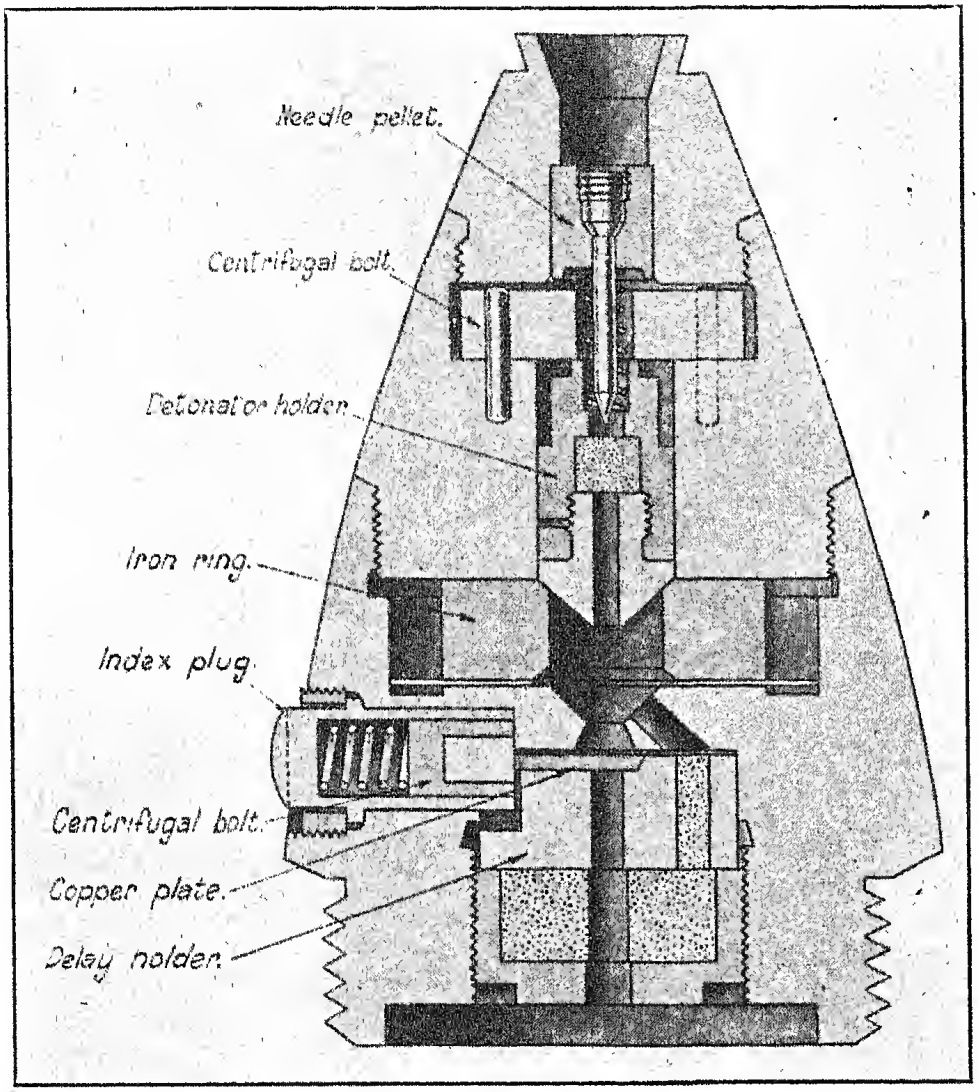


FIG. 7.

described. The only difference is in the dimensions and in the following points of detail :—

(1) The body of the fuze is in three parts instead of two, the three parts being screwed and pegged to each other.

(2) The detonator holder is of a slightly different form with a lower end of truncated cone shape, screwed and pegged into the cylindrical part containing the detonator.

(3) A cylindrical iron ring held by the prongs of a brass washer is held between the centre and lower portions of the body. It supports the detonator holder against the effect of set back and has a central hole communicating with the open central channel and with the channel containing the delay through an oblique passage.

(4) The delay holder is marked 0·15 instead of 0·25.

The delay mechanism and the method of operation are identical with those of the fuze AZ.23 R.h.S. (0·25).

6. Percussion fuze AZ.23 Rh.S. (0·8) umg.

FIG. 8

This fuze has only been found in 15 cm. shells. It is generally similar to the AZ.23 R.h.S. (0·25) previously described—the only difference being in its dimensions and in the delay mechanism.

It consists chiefly of a brass body, a fixed lower ring and an upper setting ring which can be turned by means of notches, using a special key. The lines at O.V. and M.V. can thus be brought to coincide with the lines marked on the body and lower fixed ring.

The fixed lower ring is screwed and pinned to the body. It bears on a shoulder on the setting ring and thus secures it in position. The setting ring on the underside is formed with three distinct bearing planes by means of which the delay mechanism is actuated.

Delay mechanism.

This differs from the AZ.23 (0·25) fuze, in the control mechanism. In this case the copper plate instead of being free in relation to the centrifugal bolt is attached to it by a small pin. Displacement of the centrifugal bolt and consequently the copper plate under the effects of centrifugal force can be prevented by the stem of a detent which is actuated by a spring.

The position of this detent is controlled by the bearing planes of the setting ring. When Part 1 of the bearing planes is over the detent (setting M.V.) as shown in section in Fig. 8, the stem of the latter protrudes into the space in which the centrifugal bolt is positioned and prevents its movement. The central channel is thus closed and the fuze can only function on delay.

When Part 2 or 3 of the setting planes (setting O.V.) is brought over the detent, the latter is free to move slightly longitudinally and, under pressure from its spring, its tip is withdrawn from behind the centrifugal bolt. The bolt can then move outwards and compress its spring thus withdrawing the copper plate and leaving the central channel of the fuze clear.

It will be observed that the setting cap has three bearing planes, although only two are required in this fuze. The reason for this is that the setting cap is identical with that used with the AZ. 23 umg. M.2.V. (which is similar to the AZ.23 (0·8) umg.) in which the three settings (no delay, 0·2 delay, 0·8 delay) are used. In this case, the three planes are necessary. It is, therefore, probably with a view to securing standardisation that the fuze described here has three planes as in the corresponding setting cap of the AZ.23 umg M.2.V.

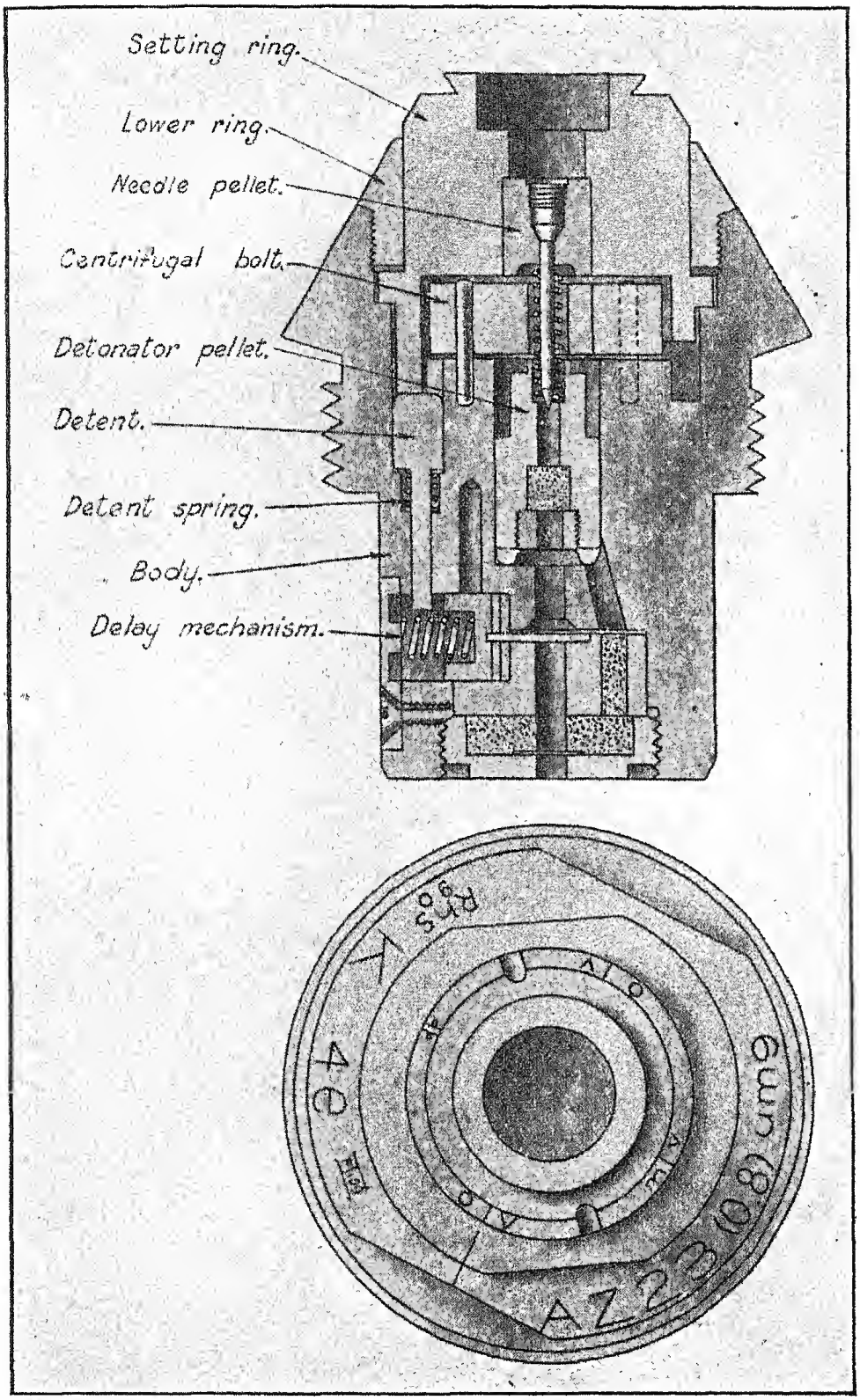

Setting ring.
Lower ring.
Needle pellet.
Centrifugal bolt.
Detonator pellet.
Detent.
Detent spring.
Body.
Delay mechanism.
AZ 23 (108) 6mm

FIG. 8.

7. Fuze T. & P. Clockwork DOPP. ZS./60s.

FIG. 9

This fuze is used for air burst ranging. The body is made of duralumin with the clockwork movement in bronze. A number of these fuzes have been recovered, but they have been very deformed

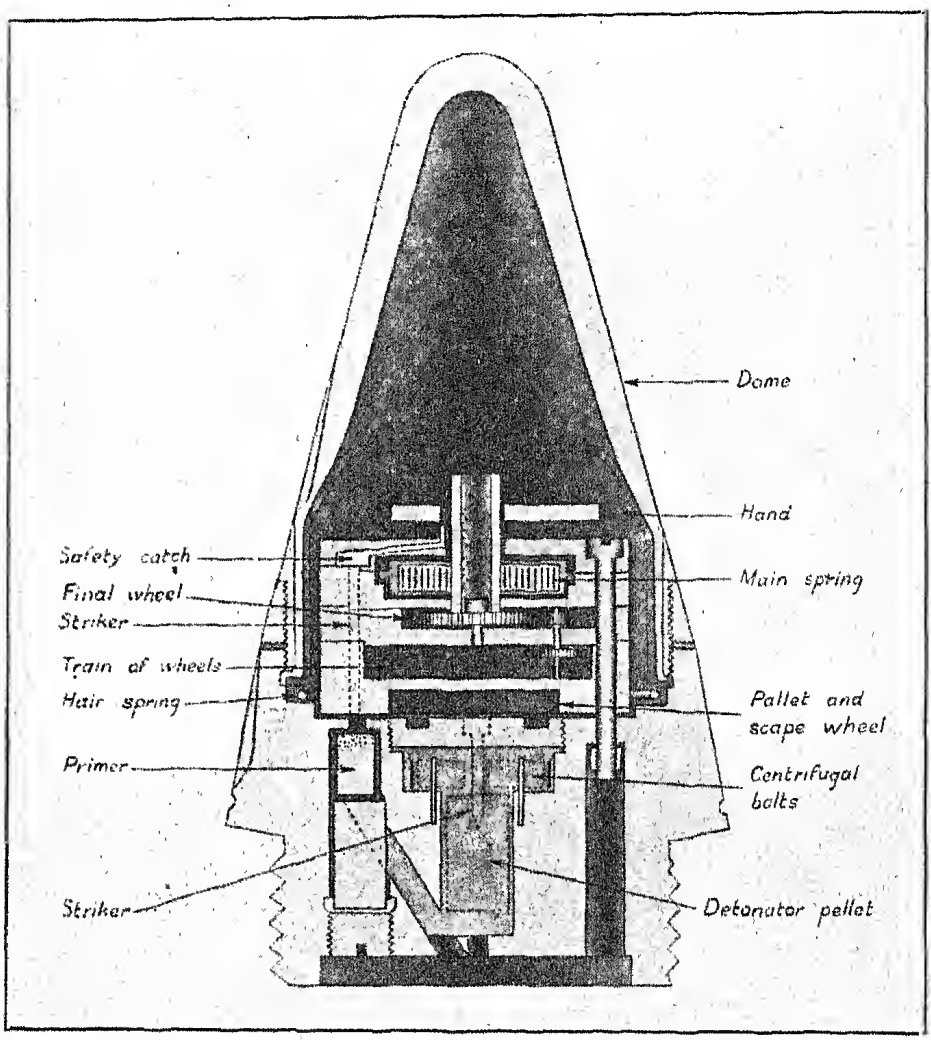


FIG. 9.

so that it has not been possible to give full details of the mechanism. This seems to be approximately as follows :—

Time mechanism.

The clockwork movement is attached to the body of the fuze by three screws, arranged at intervals of 120°. It appears to resemble clockwork fuzes used by the Germans in 1914-1918.

It consists of :—

(*a*) a pallet and scape wheel. The timing of the oscillation is controlled by a hair spring of 0·6 mm. spring steel

15 cm. long, which passes round the outside of the clockwork movement.

(*b*) the scape wheel driven by a train of wheels with a ten-tooth pinion and 56-tooth wheel engaging a final wheel (40 teeth) fixed to the main spring drum.

(*c*) the main spring, ratchet wheel (60 teeth), striker, safety catch, hand, etc.

By using the slots in the body and in the head of the fuze, the dome is turned until the fuze is set at the correct fuze length.

After the primer has been struck the flash is carried to a detonator which is probably the same as that in the percussion system.

Percussion mechanism.

The percussion system is below the clockwork movement. It was very broken in every case and consequently is only shown in the Fig. by dotted lines.

It consists of a safety mechanism of four centrifugal bolts of ordinary type and a detonator pellet which, on graze, is carried forward on to the striker which is fixed.

Some fuzes instead of being engraved DOPP. ZS./60s. had the same marking with the " s " barred out. Factory markings, such as Rh. S. 1936 have been found.

8. Fuze T. & P. 10 cm. VZ.21n.

FIG. 10

This fuze which is constructed partly in bronze and partly in steel, is of the combustion type with two time rings filled with powder burning composition, the top ring being fixed and the bottom movable. The bottom ring revolves between two felt washers and is graduated from 0 to 241 sub-divided into tenths the fuze being set by revolving the bottom ring until the required graduation is opposite an index line on the base of the fuze. To protect the powder filling against moisture, a cap is placed over the fuze and is soldered to the base. Presumably some form of water-proofing the time rings is also used.

The time mechanism consists of a primer case supported by a safety clip and held in position by a safety pin which is withdrawn at the moment of loading.

A percussion pin is fixed in the body of the fuze below the primer.

Percussion mechanism.

Only fragments of the percussion system were found. These consisted of a striker fitted with an aluminium head. No manufacturing marks were visible.

Action.

On firing the primer case sets back crushing the safety clip and strikes the percussion pin. The flash is carried to the upper time ring which burns for a period dependent on the setting, then to the lower graduated ring and eventually by the diagonal channel to the magazine in the ordinary way.

The gas from the burning composition in the time rings escapes through large vents, one in each time ring.

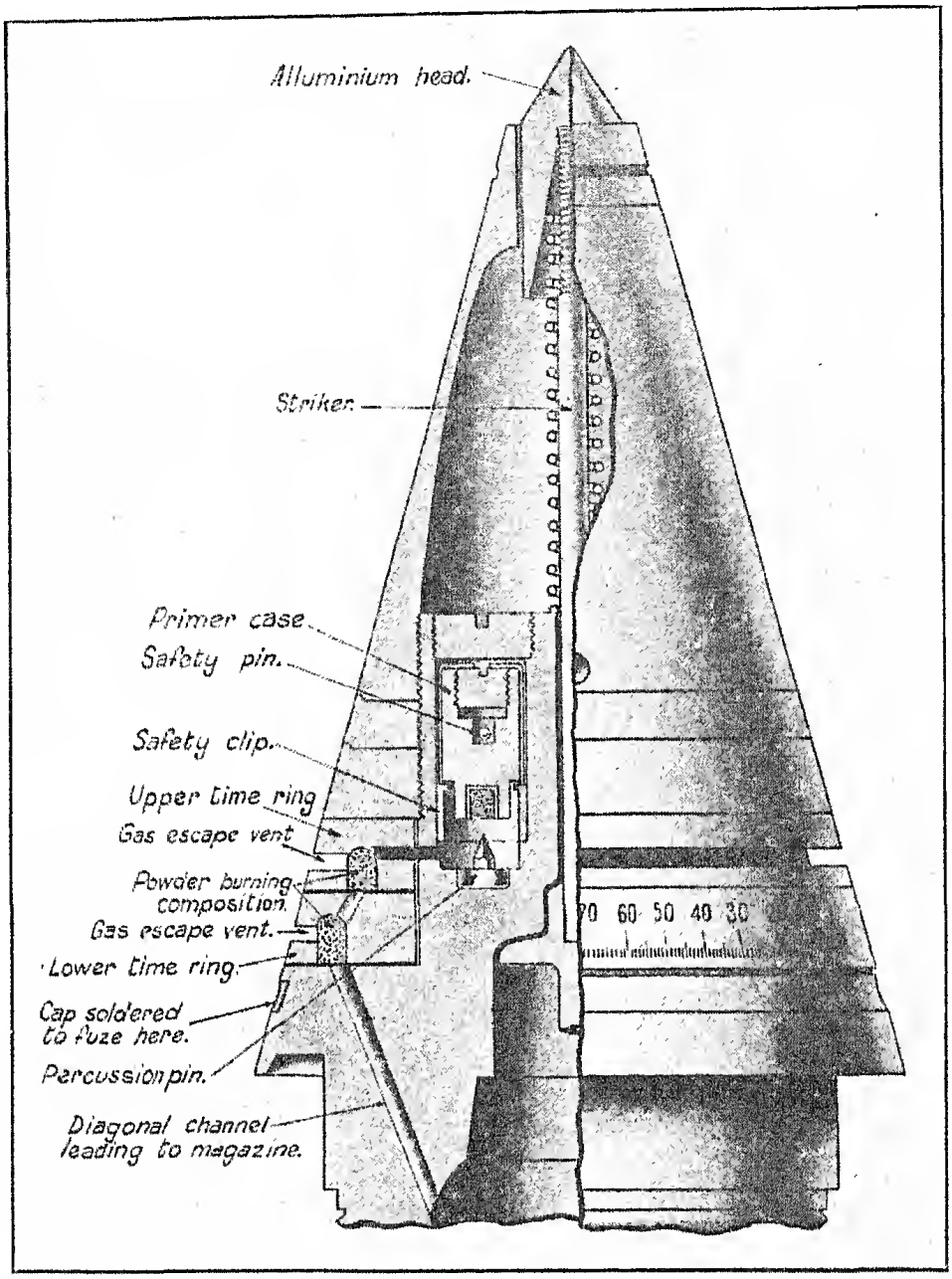


FIG. 10.

9. Fuze T. & P. 15 cm. VZ.25

This fuze is generally similar to the 10 cm. VZ.21n., differing only in the following particulars :—

(*a*) the diameters of the screw threads and of the base plates are slightly larger and the overall length is slightly less.
(*b*) the graduations on the bottom ring are from 8 to 245.
(*c*) a few details, particularly the shape of the striker, are very slightly different.

10. 20 mm. aircraft shell

FIG. 11

This H.E. Shell has been found on various occasions after aerial combat between Messerschmitt and French Aircraft.

It consists of a steel body in three parts, comprising :—

(*a*) A cylindrical body.

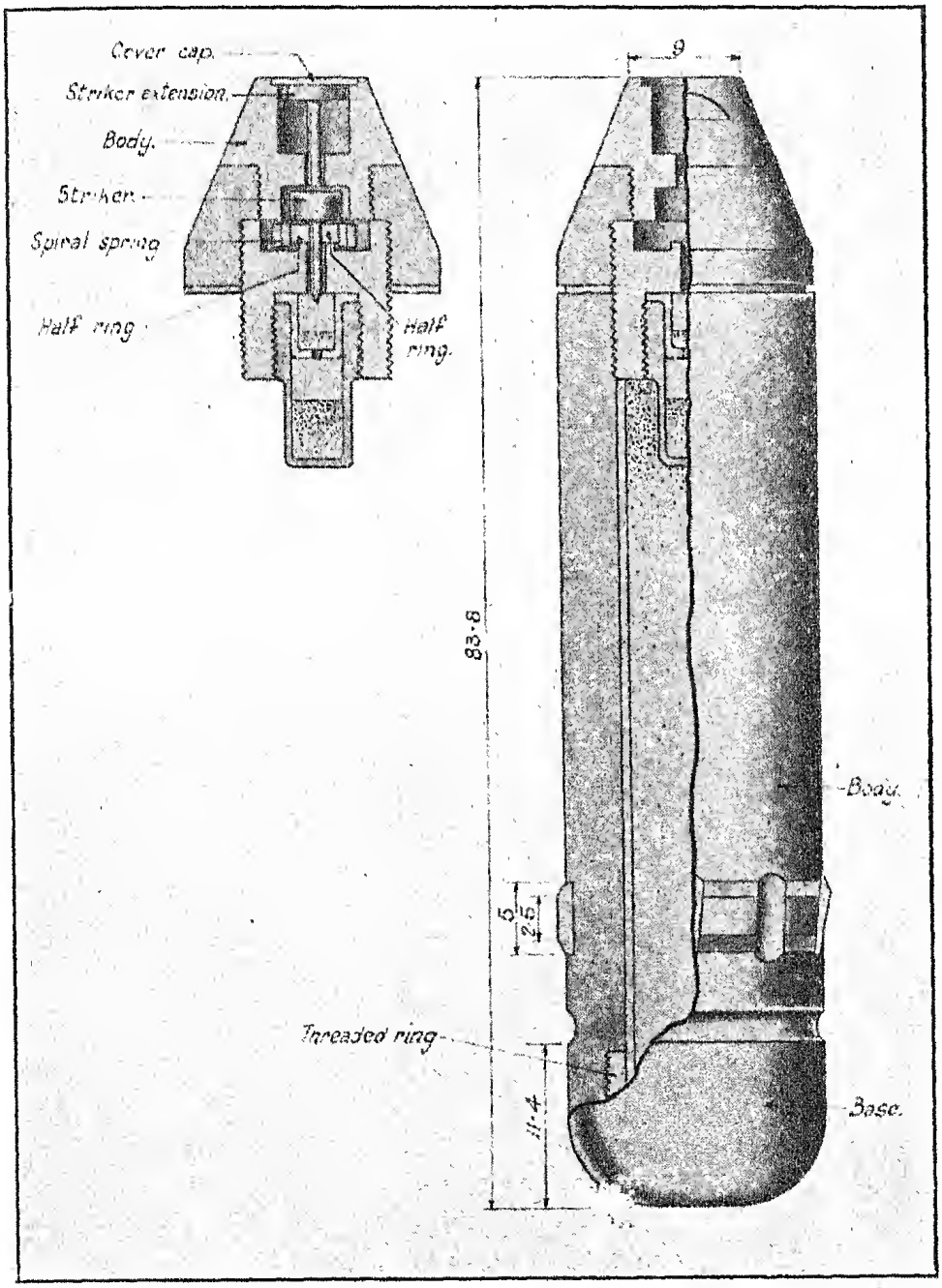


FIG. 11.

(*b*) A practically hemispherical part which forms the base of the shell.

(*c*) A threaded ring screwed inside (*a*) and (*b*) and acting as a connection between them.

At the upper part of the base a cannelure is formed which is probably for indenting the cartridge case.

The body of the shell is painted yellow as far as the cannelure, the part fitting inside the case being unpainted. It is filled with a pink-colonred explosive.

The shells recovered were fitted with either a fuze marked AZ.1502 DWM.11, or a fuze marked EKZ.dr.C./30.

Fuze EKZ.dr.C./30 is an instantaneous nose fitted on a tracer shell and carries inside it a brass tube which contains the tracer composition. This is mainly lead and manganese and is in the form of a white powder.

Fuze AZ.1502 DWM.11

FIG. 11

This D.A. fuze screws into a ring carried in the head of the shell and is fixed with three punch marks.

The body is of steel coated with brass and the nose of the fuze is closed with a cover cap.

The arming system consists of a spiral spring rolled around two half rings, which retain the striker in position.

On firing the spiral spring unrolls under the effect of centrifugal force thus releasing the two half rings, which in turn free the striker. Both spring and half collars remain inside the fuze.

During flight "creep" action keeps the striker clear of the detonator. On impact the striker extension is driven in actuating the striker.

11. German 8·8 cm. shell spreng—Patr. L/4·5 (KZ)

All dimensions are in mm.

FIG. 12

This H.E. Shell has a screwed-in base with parallel walls and two driving bands of either copper or bimetallic fitted into undercut grooves near the base. Two cannelures are formed below the driving bands for the purpose of securing the cartridge case to the shell.

For identification purposes the groove immediately below the driving band is painted black and the grooves between and above the bands are painted yellow.

The shell is filled T.N.T. wrapped in a varnished cardboard container insulated from the inside walls by four sheets of white paper and from the base by two superimposed washers of black cardboard.

This shell is used in the 8·8 c.m. FLAK 18 A.A. gun and is fitted with one of the following fuzes :—

(*a*) against aerial objectives : mechanical clockwork fuze UZS./30 ;

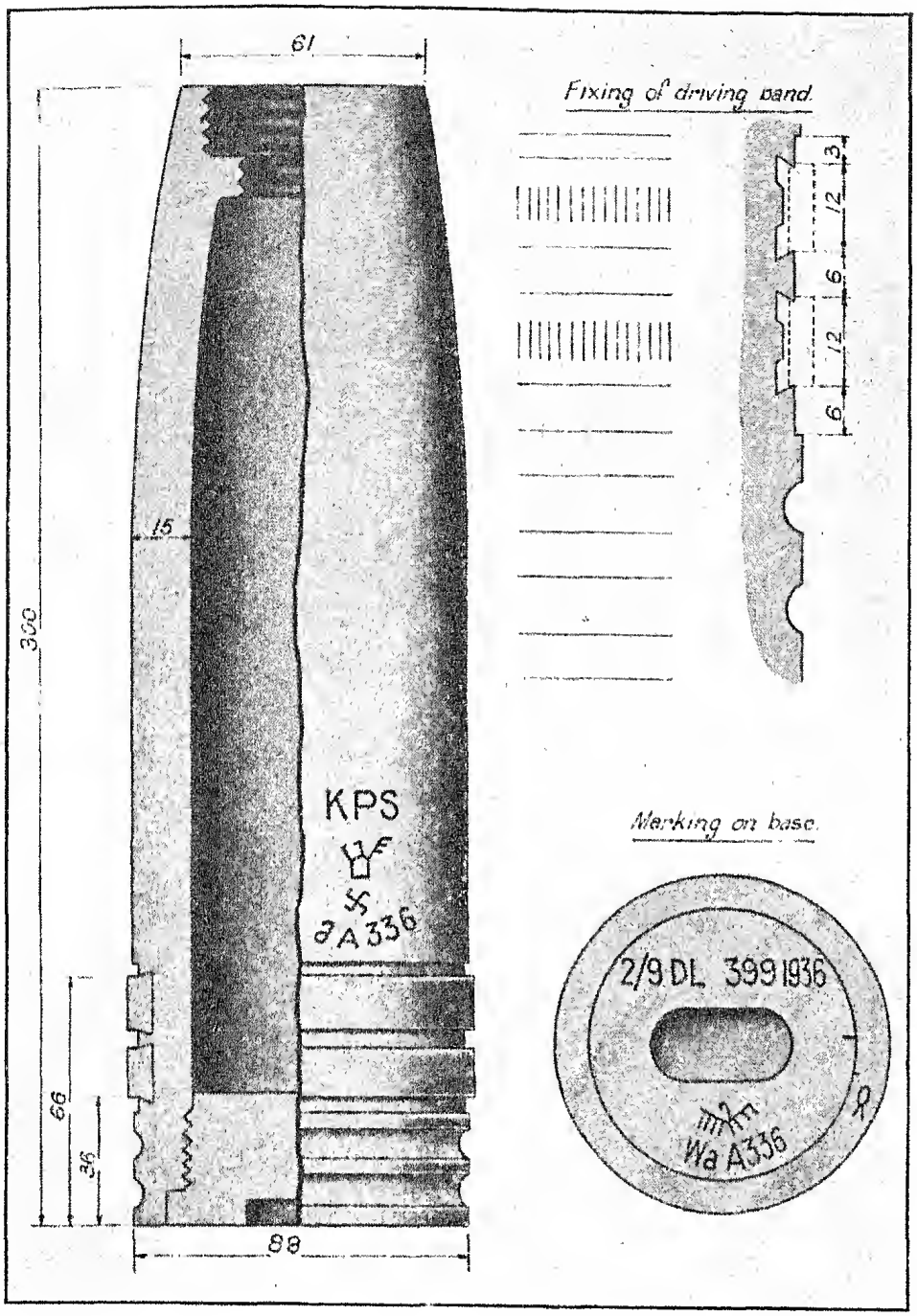


FIG. 12.

(*b*) against land objectives (armoured vehicles) percussion fuze AZ.23 (0·15) or time fuze Zt.Z.S.30 (0·5,000).

The weight of shell is 9 kgs., cartridge 14·7 kgs. and the charge 2·3 kgs.

12. 7·5 cm. separate shell

FIG. 13

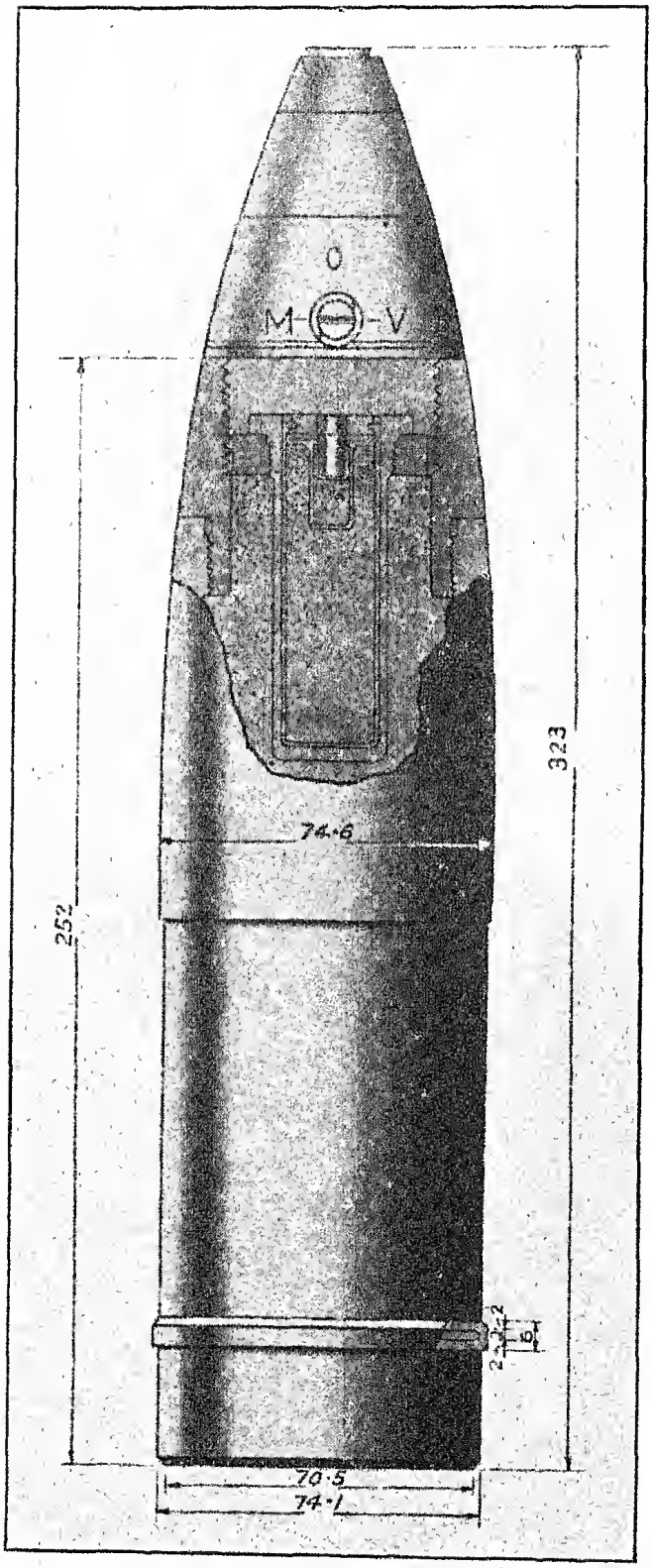


FIG. 13.

This shell, of steel, has a screwed-on head and a parallel base fitted with one driving band.

The H.E. filling, probably T.N.T., is brought to the level of the ring securing the exploder container. The inside walls are protected by varnish.

The shell recovered was painted Green and fitted with fuze J.Gr.Z.23 n.A. (0·15) R.h.S. 1937 previously described.

The explodering arrangements are identical with those used in the 10·5 cm. shell (Fig. 14).

It is very probable that the above shell is that used by the Light Infantry gun, which fires, as also does the heavy cm. infantry gun, a shell with a separate propelling charge. On the other hand the firm of Rheinmetall has made a 7·5 cm. L./25 gun with split trail, and a 7·5 cm. L./42 gun (long range) mounted on a split trail carriage of the 10·5 cm. model 18 light howitzer. The above shell could have been fired by one of these weapons or by a 7·5 cm. FK. 16n.A.

Weight of shell without fuze 5·2 kg.

13. Streamlined 10·5 cm. shell with one driving band

FIG. 14

Fig. 14 shows the principal features of a German 10·5 cm. H.E. shell fitted with one driving band and a percussion fuze AZ.23 with ·25 in. delay.

The shell is streamlined and fitted with a screwed-on head. The driving band consists of an inside portion of mild steel or iron and an external portion of copper. The method used to prevent the band slipping round the body of the shell is by simple knurling. The adhesion of the copper to the iron is so good that twisting of the band on firing does not cause any separation between the two metals. The reason is not clear whether the two-metal driving band is due to shortage of copper or as a remedy for the tearing off of driving bands.

The shell filling is probably T.N.T. In some cases the filling is effected by pouring, the shell being protected internally by varnish, and in other cases by block charges, each contained in a carton cover, a plastic substance being used to make a joint between the covers and internal surface of the shell. The shell is filled up to the level of the ring securing the exploder container.

The steel exploder container is secured by means of a steel securing ring, the inner thread of which is screwed to the container, and the outer thread to the fuze hole of the shell. These two components are treated externally with a protective coat of black preservative the nature of which is not specified.

An exploder of **PICRIC ACID** contained in a cylindrical casting of tinned brass fits into the container.

The detonator containing the cap is housed in the upper part of this casting. The detonator consists of a small copper thimble pierced by five holes (nature of filling not stated). The thimble is closed by a washer, the central hole of which is closed by a paper disc. The detonator is held in position by a leather washer crimped into the edge of the cylindrical brass casting.

The same type of exploder appears to be used in 75 and 150 mm. H.E. shells.

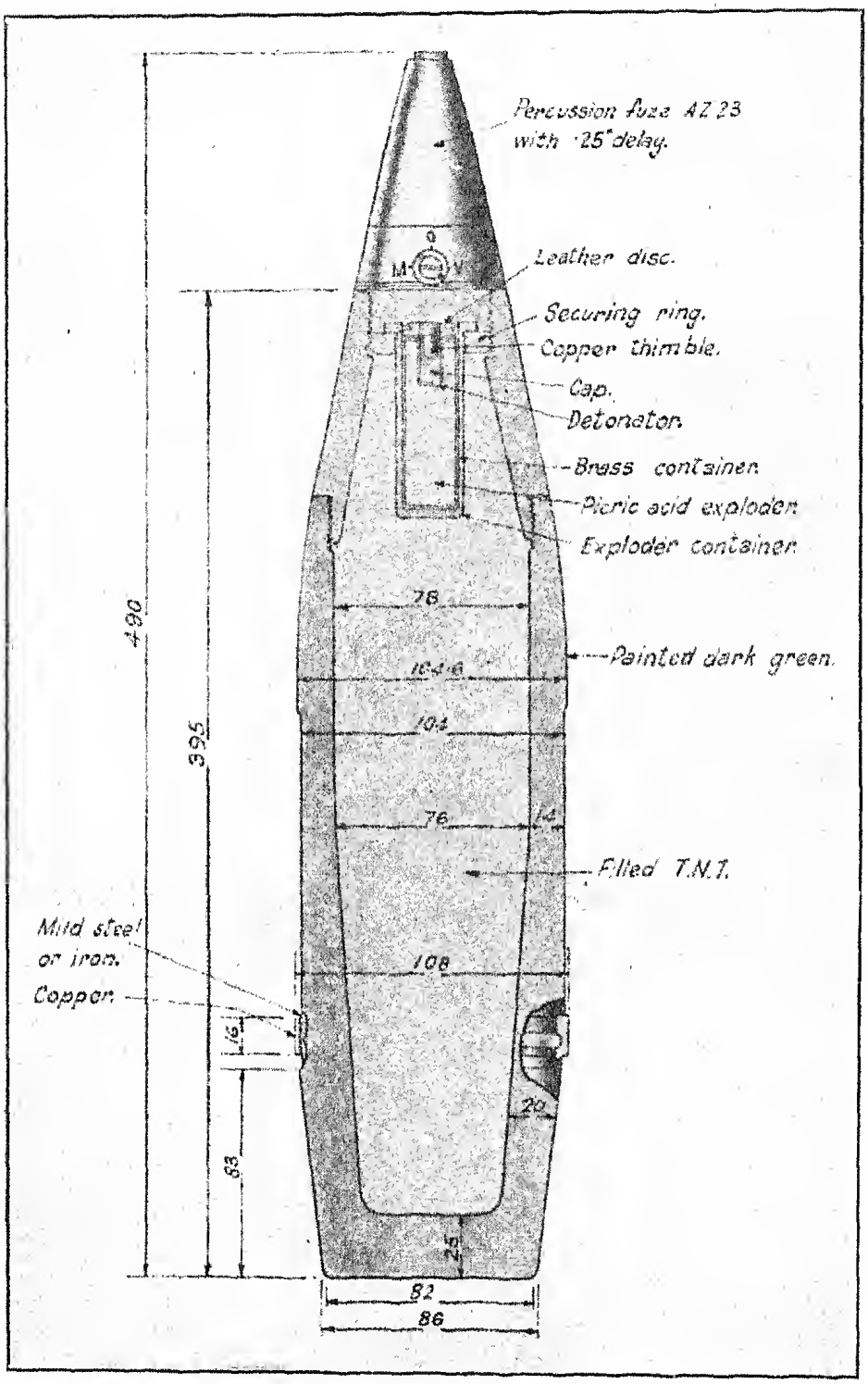


FIG. 14.

The driving bands of certain projectiles of 105 and 150 mm. are in some cases of copper only and in this case the method used to prevent the band slipping is in the form of a checker pattern.

14. Streamlined 10·5 cm. shell with two driving bands

FIG. 15

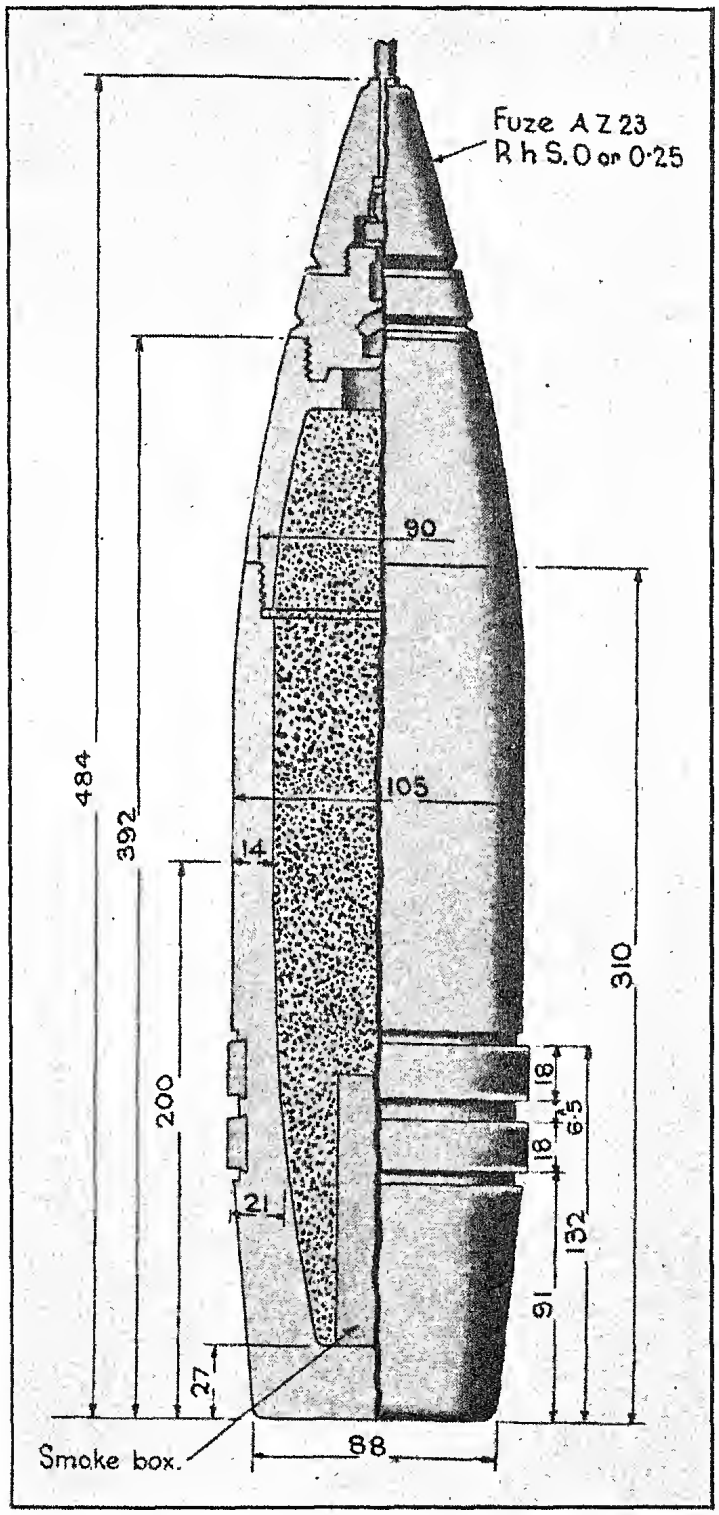


FIG. 15.

This shell is fitted with two driving bands 18 mm. wide, a screwed-on head and has a solid base.

It is filled with a yellow explosive contained in a cardboard wrapper which is separated from the metal by a layer of plastic compound. For ranging shell the base of the filling contains a smoke box of red phosphorus.

Shell of this type which have been recovered were fitted with aluminium fuzes AZ.23 R.h.S. 1938, with delays 0 and 0·25 or without indication of delay.

15. 15 cm. Shell with two driving bands

FIG. 16

This shell has a solid head and a screwed-in base, the latter having two spanner notches. The base is streamlined.

The explodering arrangements consist of a gaine in the form of two superimposed cylinders. The upper and larger end screws directly into the fuze hole of the shell and inside it fits the cylindrical lower end of the fuze. The exploder container fits into the lower cylinder. The exploder is identical with that used in the 10·5 cm. shells.

The shell is varnished inside and the filling, probably T.N.T., comes up to the level of the lower edge of the gaine. In certain samples recovered the filling is done in loose cartridges with cardboard wrapping.

The total weight of the shell without the fuze is 42·7 kg.

The fuzes which appear to be used with this shell are :—

(i) either the steel fuze AZ.23 umg M.2 V. R.h.S./90, operating without delay or with 0·2 or 0·8 delay ; or

(ii) the brass fuze AZ.23 (0·8) umg R.h.S.K. 5°, operating without delay or with 0·8 delay.

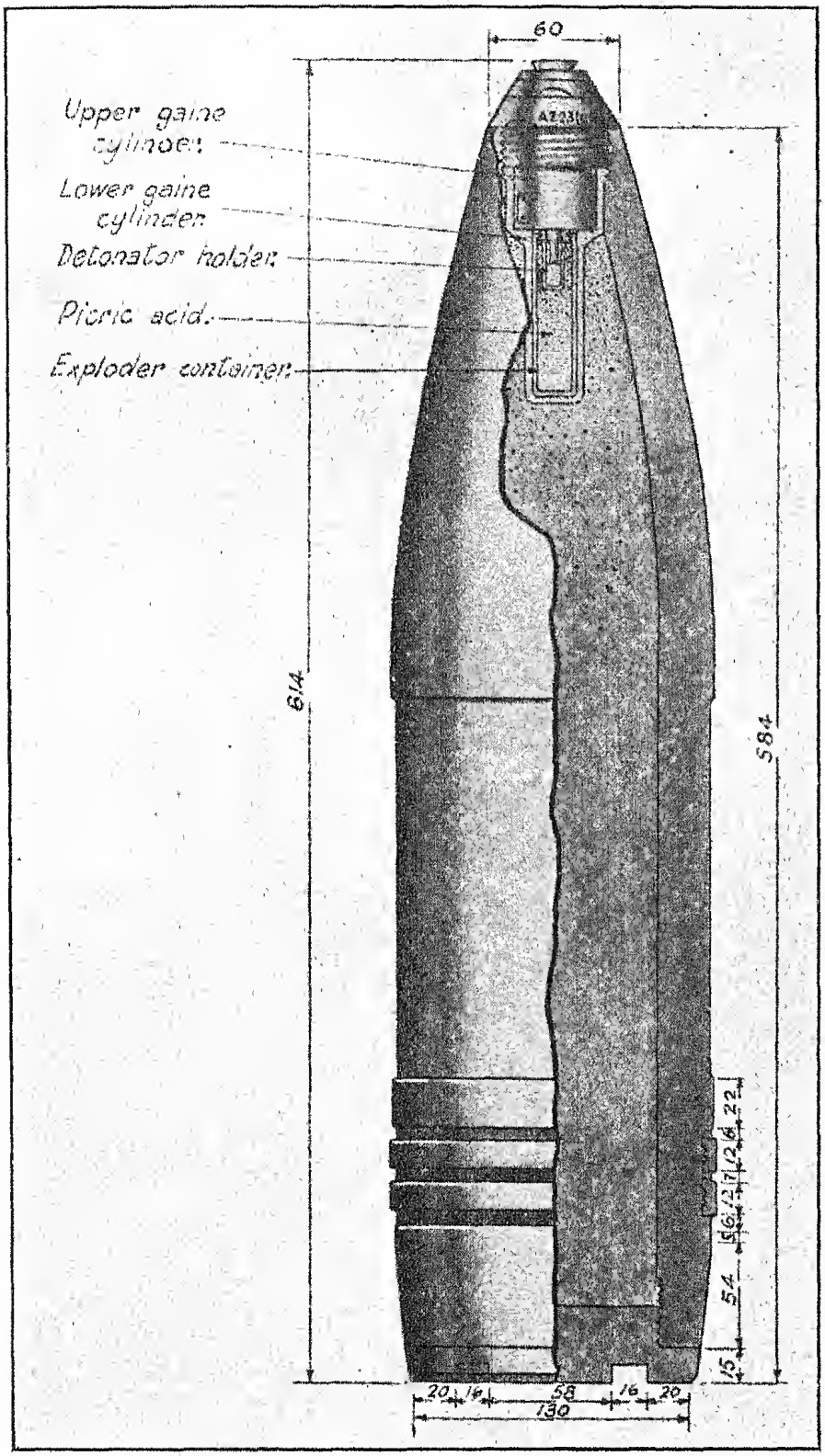

60
Upper gaine cylinder
Lower gaine cylinder
Detonator holder
Picric acid.
Exploder container
614
584
54
15
20
16
58
16
20
130

FIG. 16.

16. 15 cm. H.E. Shell

FIG. 17

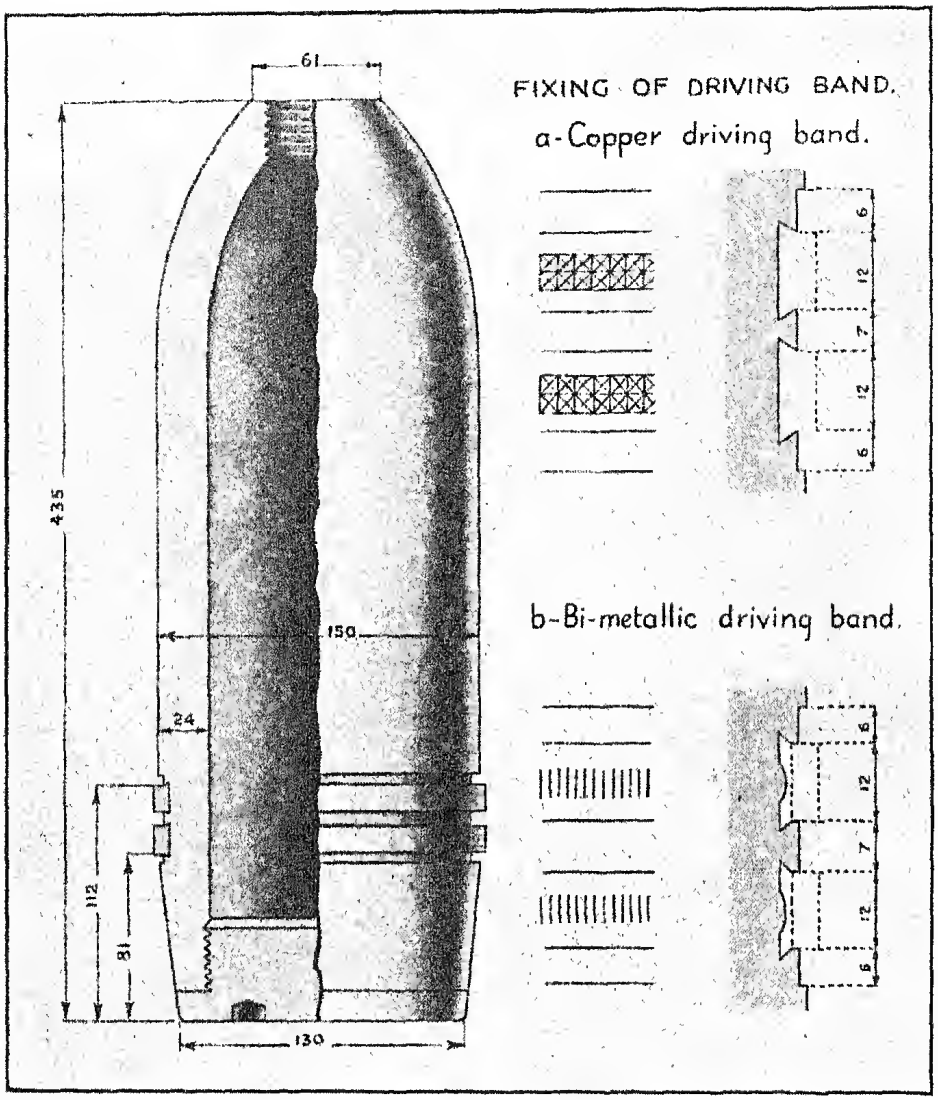


FIG. 17.

This shell is streamlined, with parallel walls, a screwed-in base piece and a head of about 1½ calibres which is threaded to take a nose fuze. The base is fitted with two driving bands of either copper or bimetellic.

17. 1 kg. incendiary bomb

FIG. 18

This type consists of a thick walled tube 9 inches long and 2 inches in diameter, made of an alloy of magnesium with a small proportion of aluminium. One end of the tube is fitted with a tail 5 inches long. The tube is filled with a priming composition of the thermit type. The bomb is fitted with an igniter which may be either in the nose or tail end of the tube.

The bomb weights about 2 lbs. 2 ozs. and, with the exception of a few ounces in the tail and igniter, there is no dead weight, the whole being incendiary material. The bomb functions on impact, a needle in the igniter being driven into a small percussion cap which ignites the priming composition. The bomb does not explode.

It should be noted that, although this bomb is often called a thermit bomb or a thermit electron bomb, the main incendiary

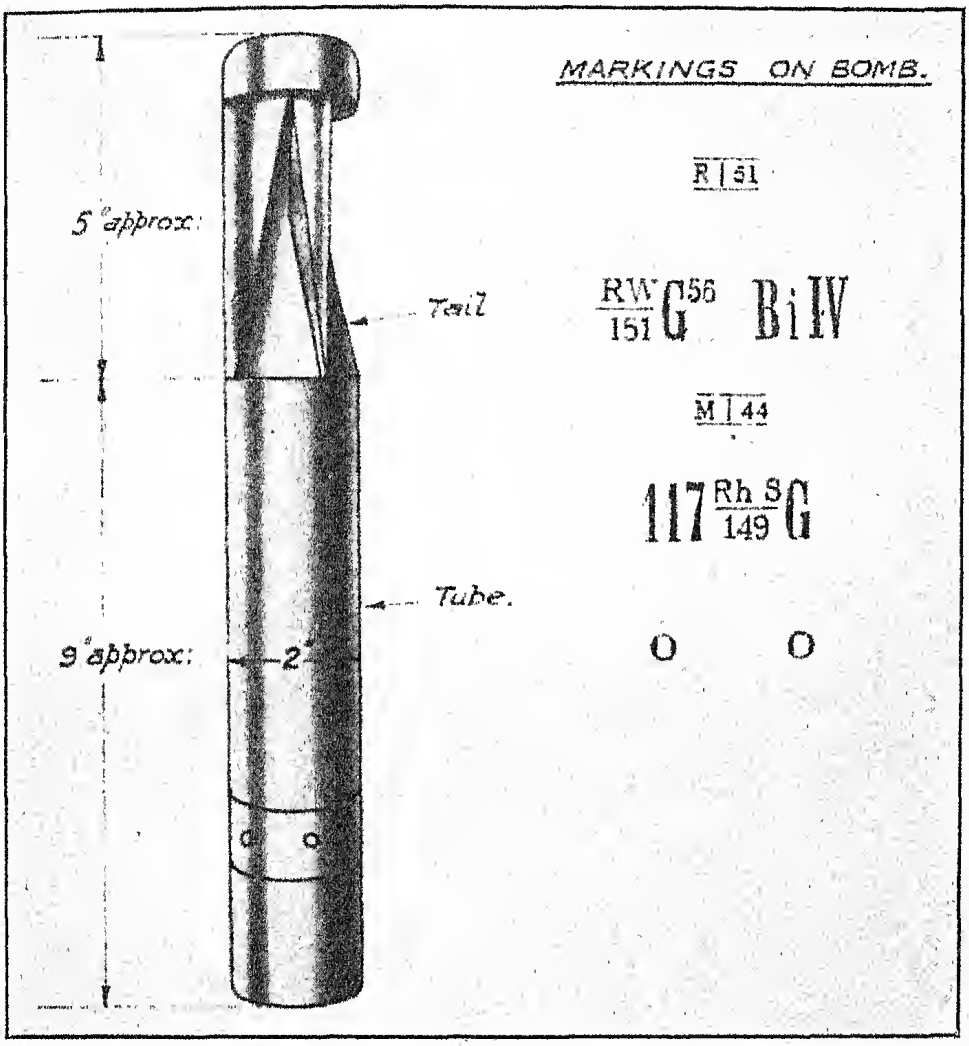


FIG. 18.

agent is not the thermit composition but the magnesium tube, which is not in itself readily inflammable. The priming composition burns for 40-50 seconds at a temperature of about 2,500° C., and its great heat serves to melt and ignite the magnesium tube. The molten magnesium burns for 10 to 15 minutes at a temperature of about 1,300° C. It may remain active for as long as 20 minutes and will set fire to anything inflammable within a few feet.

During the first 50 seconds or so, while the priming composition is still burning, the bomb looks very violent. Jets of flame are emitted from the vent holes and pieces of molten magnesium may be thrown as far even as 50 feet. After the first minute the bomb becomes less active because the magnesium tube melts and the pressure within is released.

The thermit composition contains its own oxygen and so cannot be extinguished by smothering, but the magnesium must get its oxygen from the air or surrounding materials in order to burn.

18. 1 kg. incendiary bomb (filled)

FIG. 19

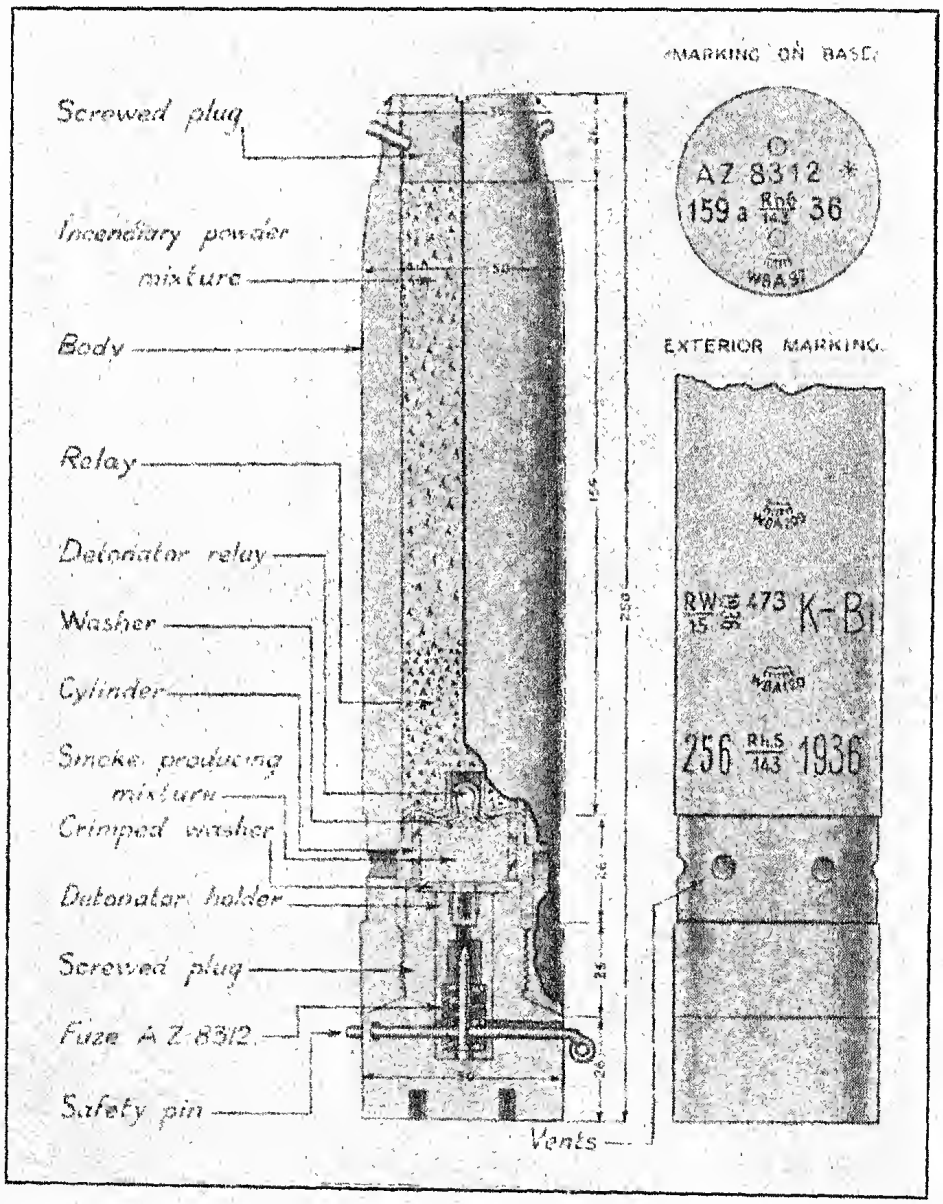


FIG. 19.

This bomb consists of a cylindrical body made of an alloy of magnesium and aluminium with traces of silicon and is closed at its upper end by a screwed plug. On the shoulder of the bomb, three pegs, which also serve to lock the plug, hold an extension which has not been identified but is probably the tail. The base is closed by a plug which houses the percussion fuze AZ. 8312.

This fuze consists of a striker, an arming spring and a detonator holder. The whole is sealed and held in position by a crimped washer. A safety pin keeps the needle clear of the detonator. The igniting arrangements consists of a detonator relay kept away from the plug by a washer and a cylinder with vents drilled in it. The whole is covered by a mixture which appears to be smoke producing. The vents in the body of the bomb serve for the release of the gases. These vents are normally closed by a strip of Chattertons compound.

The main filling is in two parts. The first, of small quantity, in contact with the detonator, serves as a relay. Its composition is not known. The main filling is an incendiary powder mixtnre of iron, aluminium, etc.

19. Smoke Bomb

FIG. 20.

This bomb takes the form of a cylinder resembling in shape and size a tin of preserves.

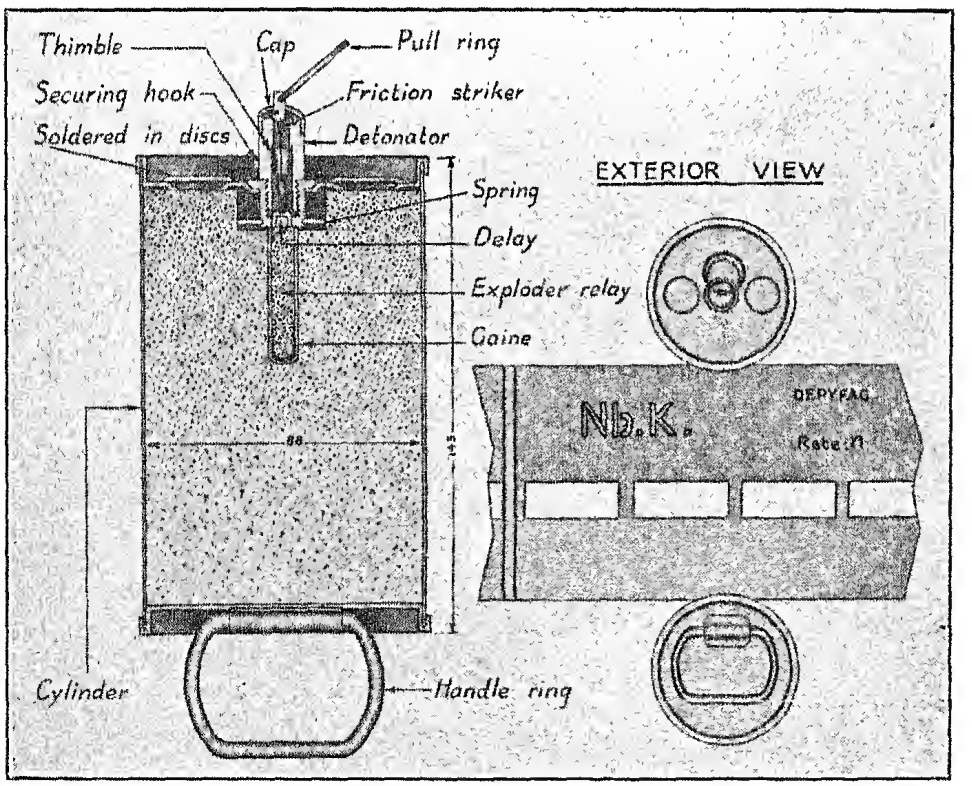


FIG. 20.

Into one end of the cylinder is screwed a detonator adapter of brass fitted with a pull ring with securing hook. At the other end is fitted a handle ring, placed eccentrically so that, when released, it falls flat on the bottom of the tin.

The cylinder is of tinned plate, pressed and soldered on the sides and ends and contains the smoke producing block. A spring limits the movement of the block in the cylinder and also prevents it coming into contact with the gaine. Two holes at the top of the cylinder are closed by discs soldered in.

The exploder is screwed into the brass adapter which also houses the gaine, soldered in.

The firing mechanism consists of :—

(*a*) A pull ring held in a safe position by a securing hook.

(*b*) A friction striker which is attached to the pull ring and passes through a small thimble of red copper which contains the detonating mixtnre. The striker consists of a piece of fine wire coiled in a spiral at each end of the thimble so as to allow for the straightening out of the wire when it is pulled. The wire is kept central at the time of pulling by the cap which can only move axially on the adapter and which a recess prevents from rotating.

(*c*) A tinned brass tube closed at one end and plugged at the other by a small brass piece containing the delay. This tube also contains the exploder relay.

Action.—When the pull ring is free from the securing hook, pulling out of this ring stretches out the striker and fires the detonator. The flash is transmitted by the delay to the exploder relay, then to the smoke mixture and the smoke pours out by the holes at the top, the closing discs of which have then become unsoldered.

Marking.—The tin is painted dark green with a white band around the centre having four equal gaps.

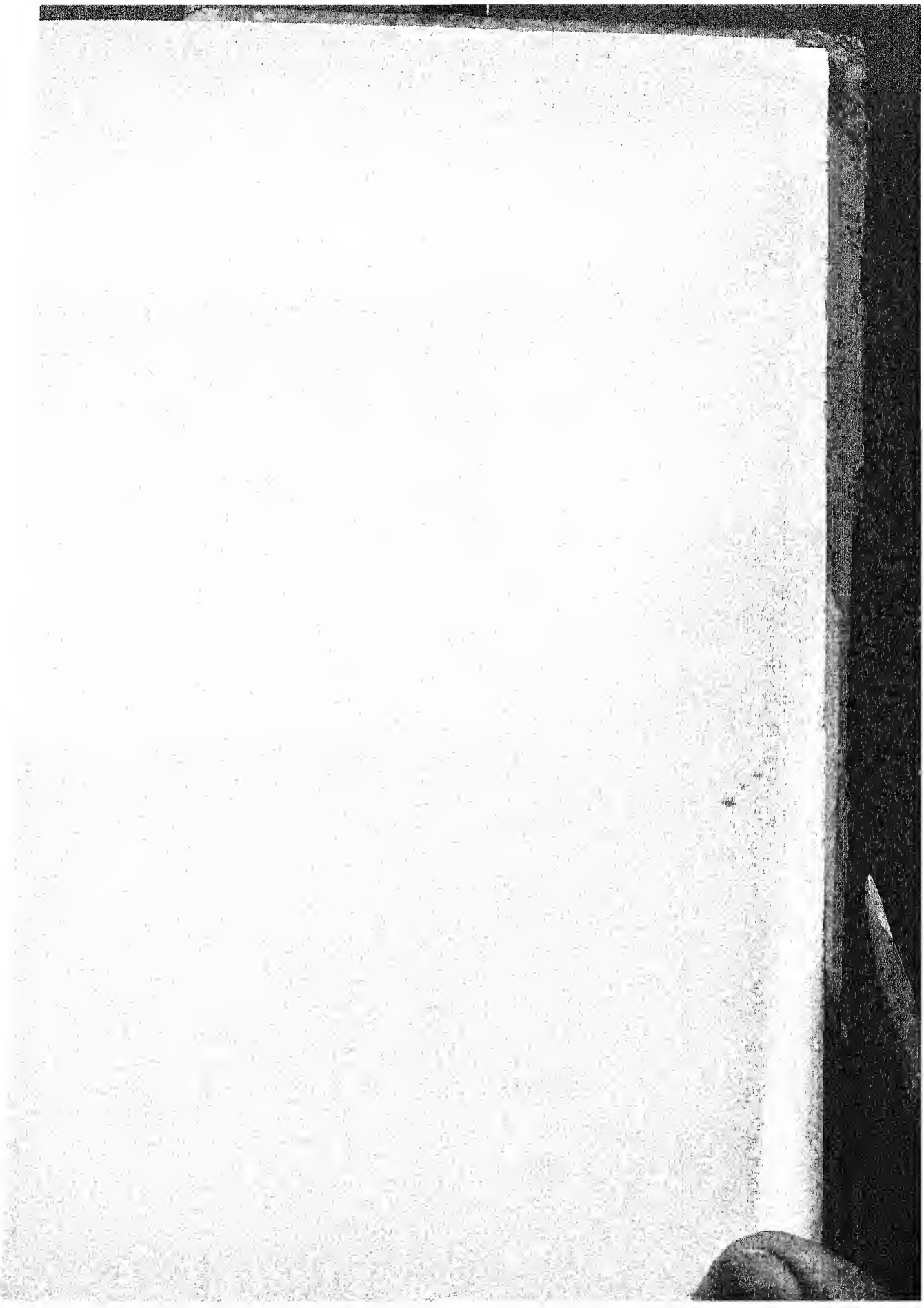
Note.—The Germans had in 1917 three types of smoke producing weapons :—

The model N.T. (Nebel-Trommel) weighing 115 kilos.
The model N.L. (Nebel-Topf) weighing 69 kilos in three loads of 23 kilos.
The model N.K. (Nebel-Kasten) which could be carried in two loads of 17 kilos. each.

These weapons were not actuated as in the bomb described above by hand pulling of a striker, but by turning through 180 degrees by means of a handle the drum containing the materials to be mixed. The model N.T. put out for 20 minutes a thick white fog which might last up to half an hour.

According to the regulation instructions on the method of use, this fog was in no way toxic but simply caused irritation in the throat. On the other hand the liquid contained in the apparatus was very caustic and would have caused injury to the eyes. Consequently, the man who was operating the weapon had to wear special glasses.

(393/4323) Wt. 23611—8555 4000 10/40 H & S Ltd. **Gp. 393**



Notified in A.C.Is. January 1st, 1941

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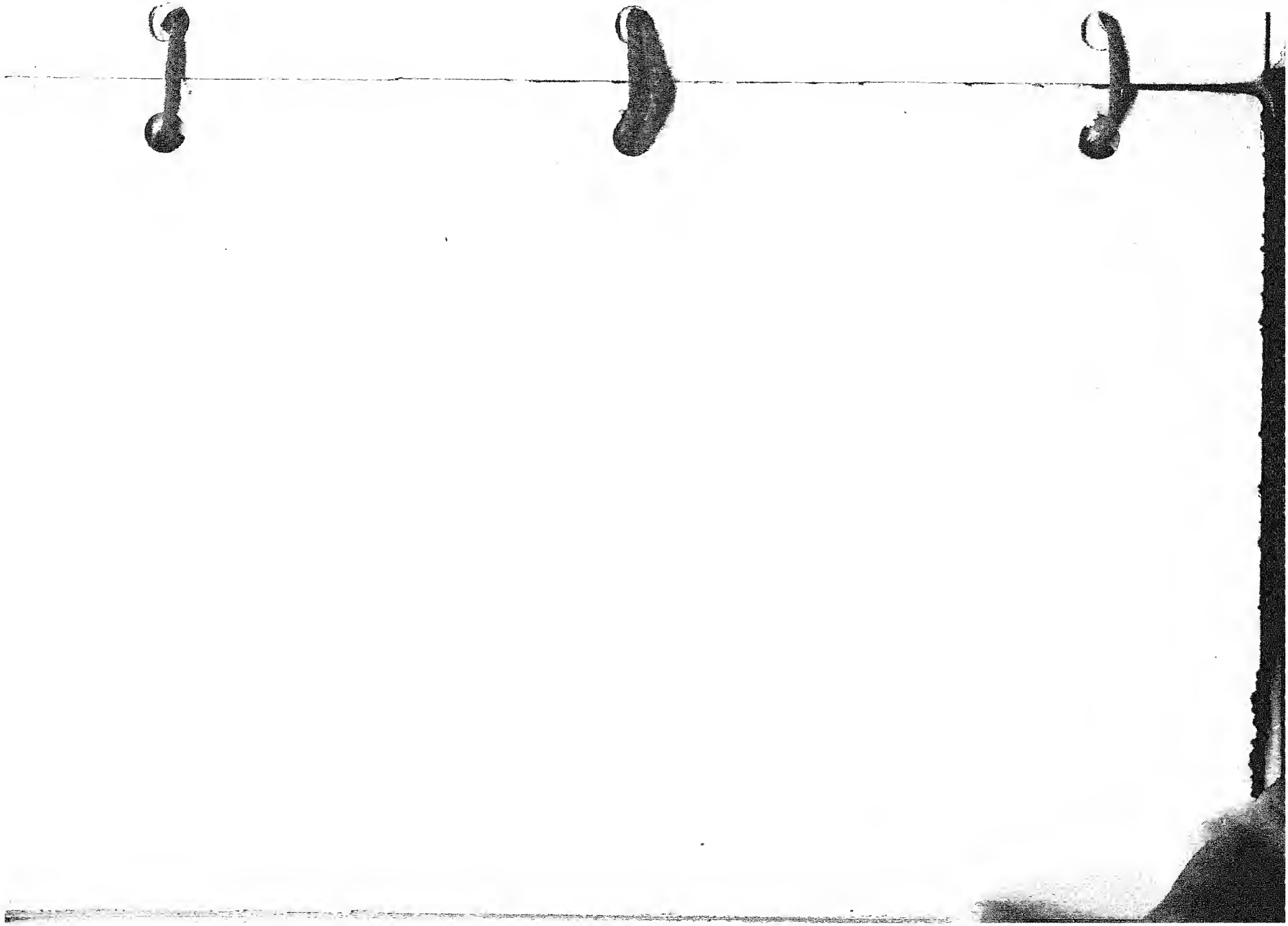
HANDBOOK OF ENEMY AMMUNITION

PAMPHLET No. 2

GERMAN SHELLS, FUZES AND SMALL ARMS AMMUNITION

By Command of the Army Council.

THE WAR OFFICE,
January 1st, 1941.



CONTENTS TABLE

SHELLS

FUZES

SMALL ARMS AMMUNITION

20 MM. SHELL.

Fig 20.

This shell, which is of unique design, was recovered without the fuze and consists of a solid drawn steel body with a hemispherical base. A driving band is fitted into a groove near the base. Immediately below the band, on the inside of the body, an aluminium ring is secured in a groove. The nose of the shell is fitted with a ring which is secured in the shell by four indents. The ring is threaded to take the fuze.

53 MM. SHELL.

Fig. 21.

The body of this shell, which is of cast steel, is in one piece and is threaded at the nose to take a direct action fuze the details of which are not complete. It is fitted near the base with a driving band and the exterior is not painted.

It has not yet been possible to identify the gun which fires this projectile as no gun of this calibre is known to exist in the German Army. This projectile is, however, very similar to the 5 cm. shell Gn used with the 5 cm. gun on pedestal mounting K. i K as L or on A.F.B. 5 cm. K. i P.L.

SKODA 37 MM. ARMOUR PIERCING HIGH EXPLOSIVE SHELL WITH BASE FUZE.

Fig. 22.

This shell has a pointed and solid head having a radius of about 1½ calibres. The walls are tapered and threaded internally at the base to take a base percussion fuze. Externally the shell is fitted with a ballistic cap welded on and a groove is formed near the base to take a copper driving band; the groove is knurled to prevent the band turning on the shell. Immediately below the driving band a small groove is formed for crimping on the cartridge case to the shell. The explosive filling is Tolite contained in a cardboard wrapping.

The weight of the shell complete with fuze and gaine is 1·73 lb.

Note.—Pieces of 37 mm. nose fuzed shell have also been recovered. The dimensions and method of fixing to the case are the same as the above. No complete shell has, however, yet been found.

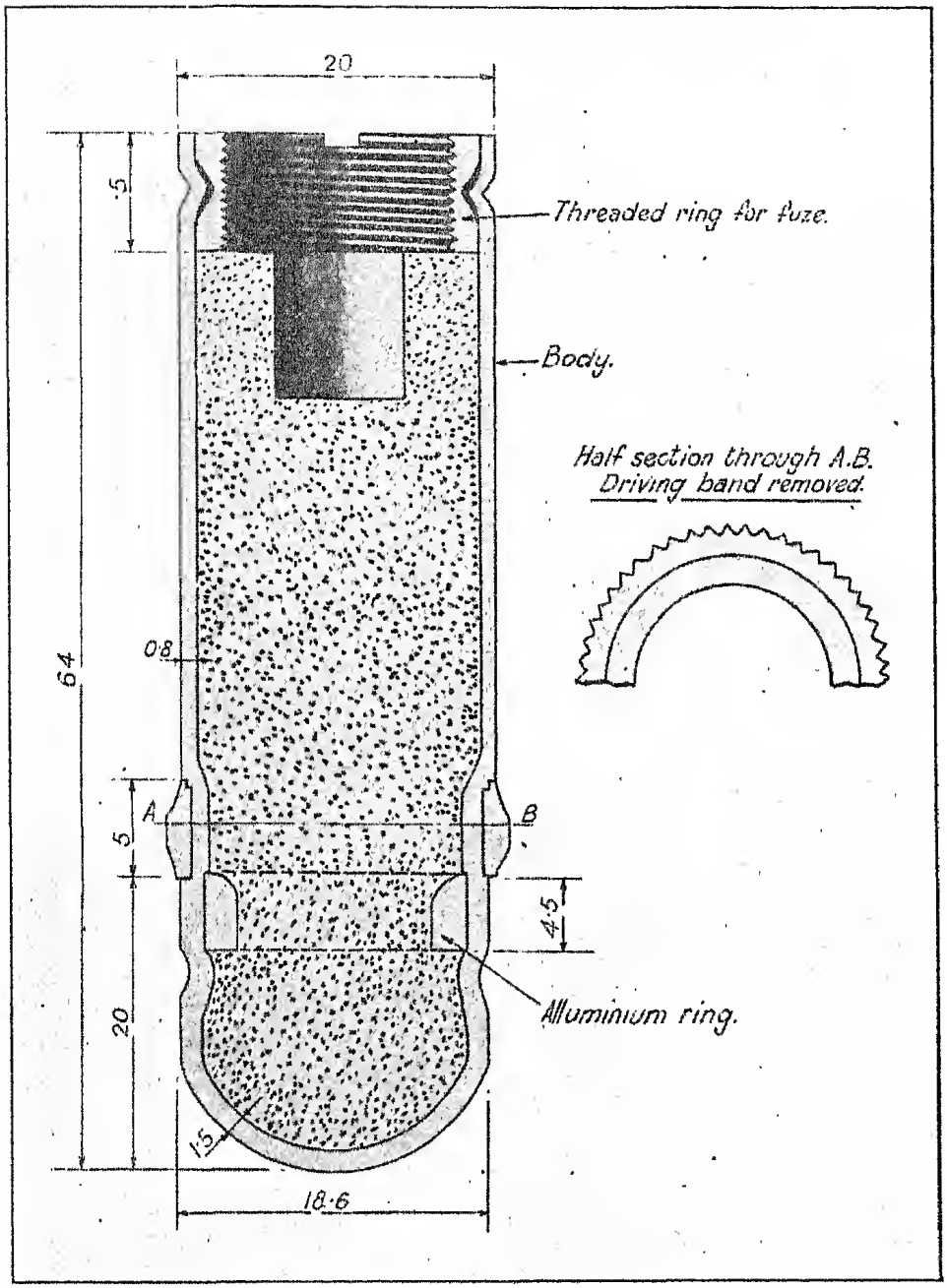

20
·5
Threaded ring for fuze.
Body.
Half section through A.B.
Driving band removed.
64
0·8
A
B
5
4·5
20
Alluminium ring.
1·5
18·6

FIG. 20.

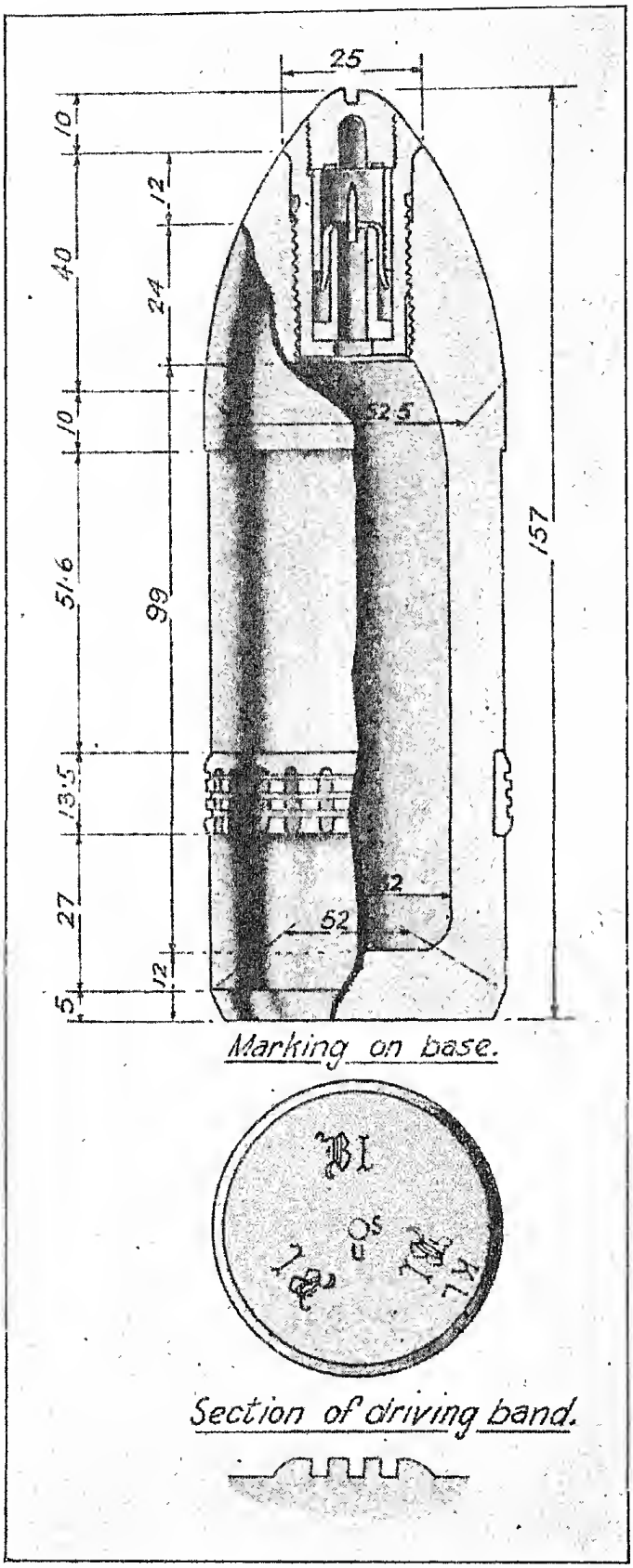

25
10
12
40
24
10
51·6
99
13·5
27
12
5
52·5
157
52
Marking on base.
Section of driving band.

FIG. 21.

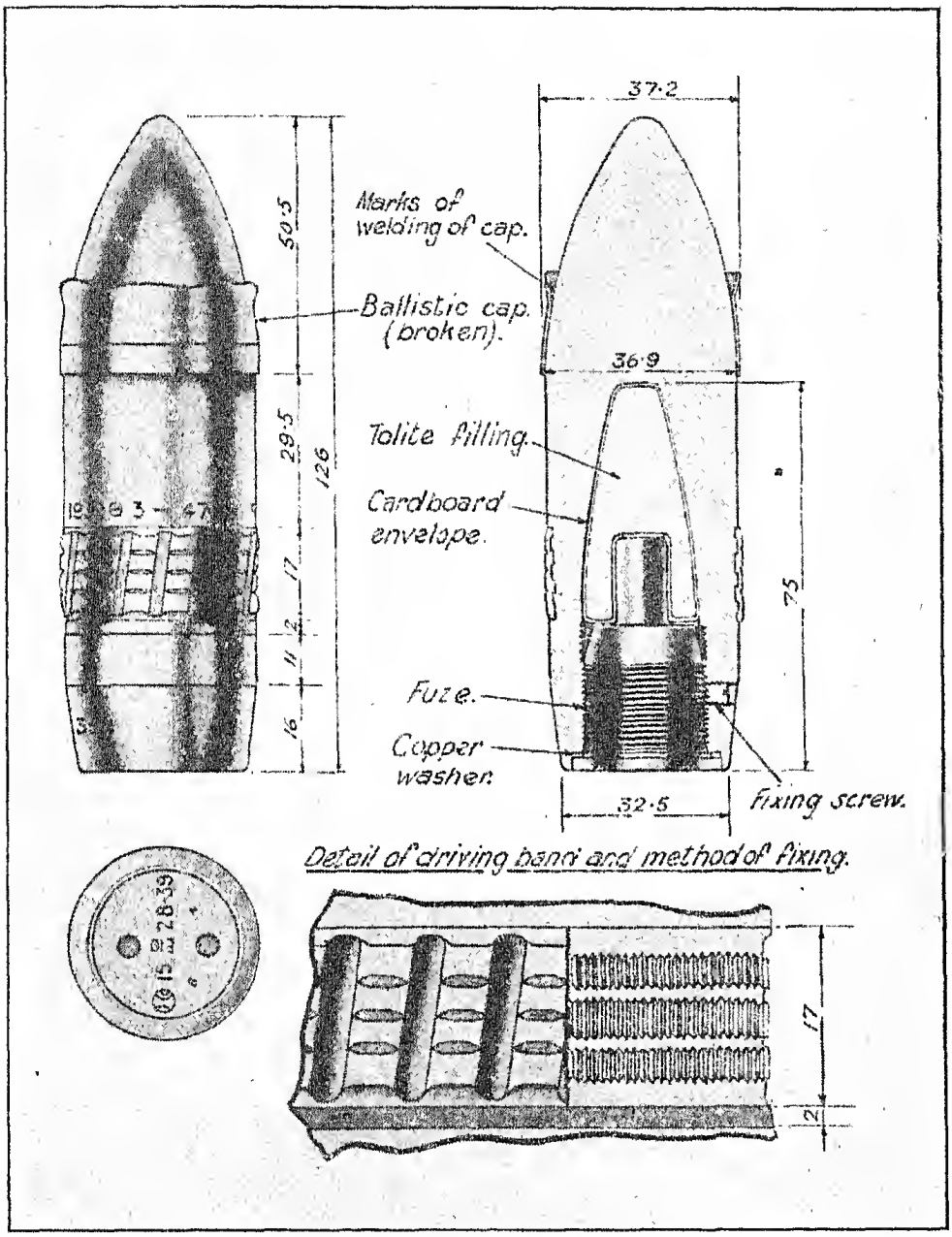
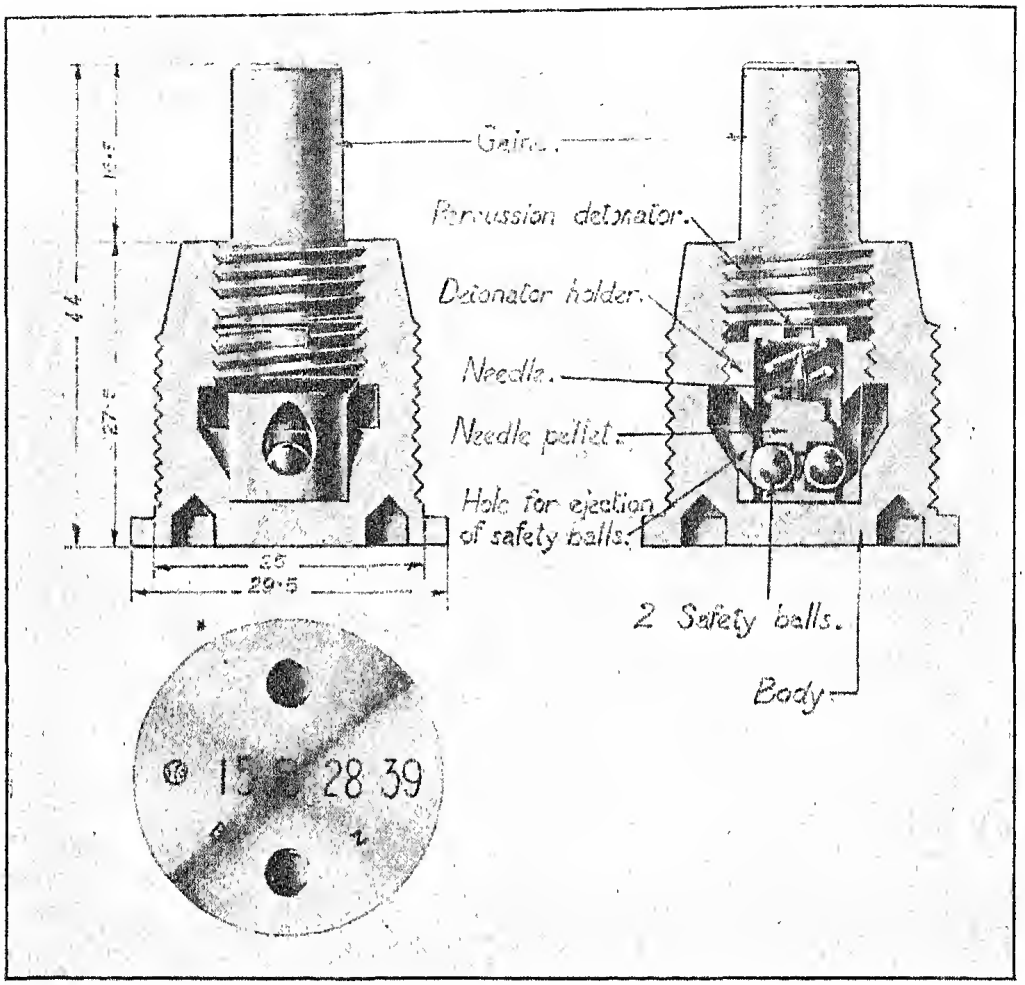

37·2
Marks of welding of cap.
Ballistic cap. (broken).
36·9
Tolite filling.
Cardboard envelope.
Fuze.
Copper washer.
32·5
Fixing screw.
50·5
29·5
126
17
2
11
16
75
Detail of driving band and method of fixing.
17
2

FIG. 22.



SKODA BASE FUZE. BZ 15–28–39.

Fig. 23.

This fuze is screwed into the base of the shell on a copper washer and is secured by a fixing screw.

It consists of a body, detonator holder, needle pellet, creep spring and gaine.

The body is of steel, varnished black, threaded externally and formed with two recesses at the base to take a key for screwing into the base of the shell. Internally it is recessed and threaded to take the gaine and detonator holder. Two inclined grooves are cut in the body near the base, these lead into a lateral recess in the body into which the safety balls move after the shell has left the bore.

The aluminium needle pellet with steel needle is housed

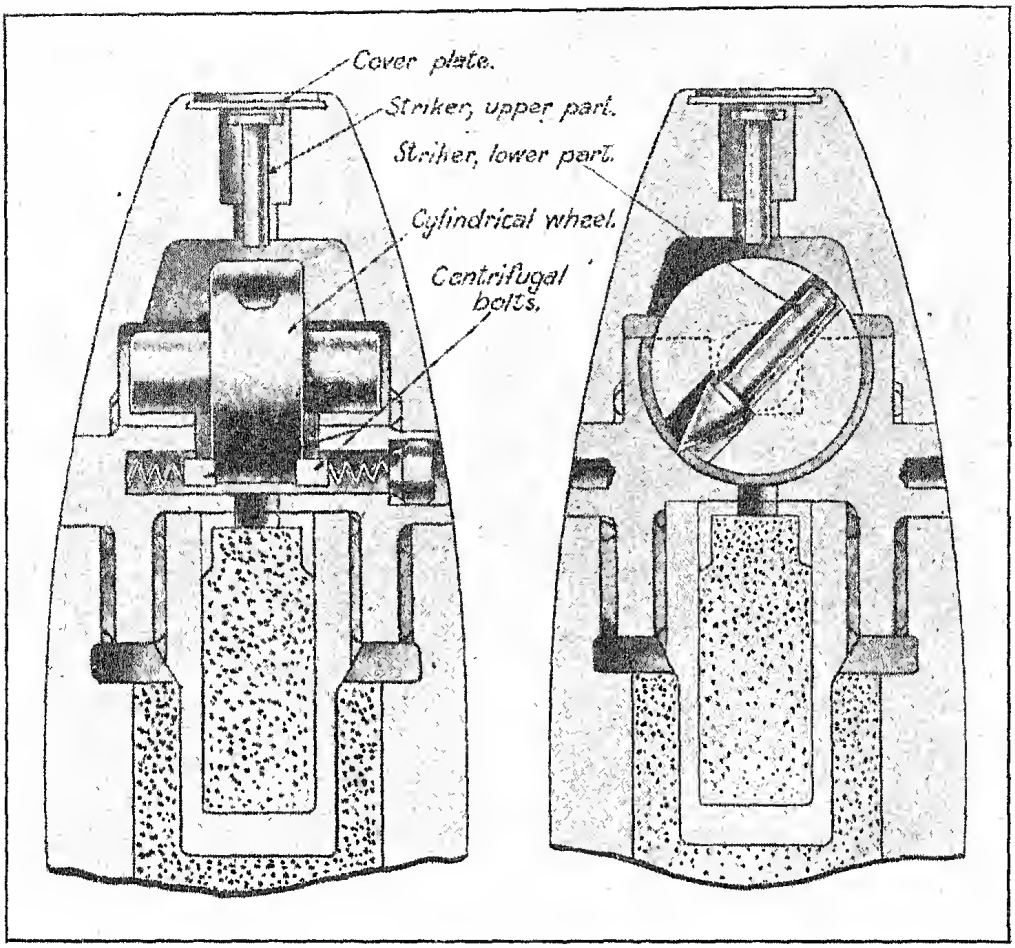
inside the detonator holder. The pellet contains two polished nickel steel safety balls which are carried in a recess at the bottom of the pellet. The function of the safety balls together with the creep spring is to retain the pellet in a safe position before firing.

The gaine is of steel, varnished black. It contains the detonator and exploder and is screwed into the upper end of the fuze body against the detonator holder.

Action.—Before firing the needle pellet is kept from the detonator by the creep spring and the two safety balls. The latter, when the fuze is at rest lock the pellet to the detonator holder.

After firing the effect of set back keeps the pellet held against the fuze body.

On deceleration after the shell has left the bore the pellet tends to creep forward overcoming the resistance of the creep spring. This movement is assisted by the safety balls which, acting under centrifugal force, are caused to ride up the inclined planes in the detonator holder into the lateral recess in the body. The forward pressure of the safety balls on the pellet having ceased the creep spring reasserts itself and returns the pellet to its original position, this movement locks the safety balls in the recess in the body. The pellet is now held from the detonator only by the creep spring. On impact the pellet is carried forward on to the detonator overcoming the spring. The flash ignites the detonator in the gaine which in turn detonates the bursting charge of the shell.



D.A. Fuze for 20 mm. Oerlikon A.A. Gun.

Fig. 24.

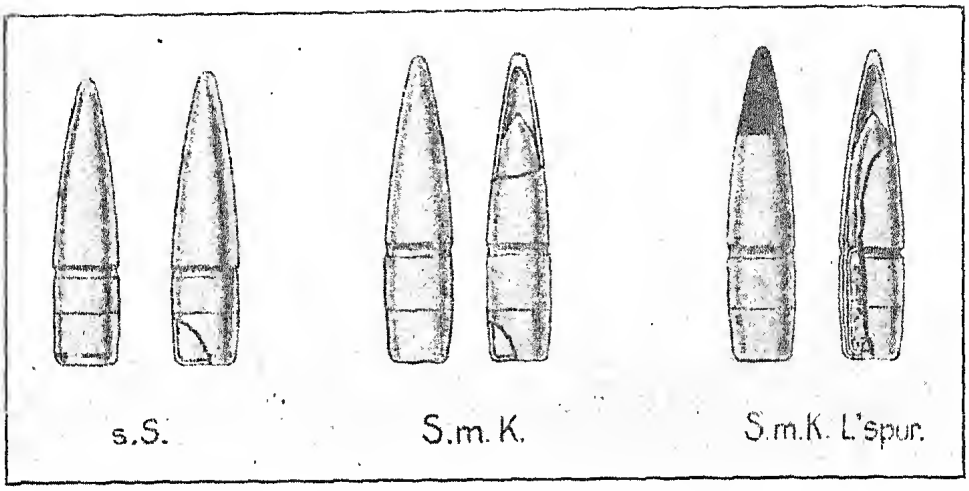
The striker is in two parts, the upper part being carried in a recess in the nose of the fuze ; the recess is closed by a cover plate. The lower part is housed in a cylindrical wheel carried in a recess in the fuze.

Before firing the various parts are assembled as shown in Fig. 24, the lower portion of the striker being inclined at an angle of about 45° to the longitudinal axis and retained in that position by two centrifugal bolts which fit in recesses one on each side of the wheel.

On firing the two bolts fly outwards under centrifugal force and free the wheel. The wheel, whose centre of gravity does not coincide with the axis of the fuze, tends, also under the action of centrifugal force, to revolve and

so bring the lower portion of the striker into line with the upper portion, but this movement is prevented by the effects of set back, due to acceleration in the bore, which forces the wheel back against the bottom walls of the recess in which it is placed.

On deceleration after the shell has left the bore, creep action causes the wheel to move slightly forward, it is then free to revolve and thus bring the two parts of the striker into alignment. Creep action and the protection of the cover plate against air pressure, keeps the striker from the detonator until it is forced in on impact.



GERMAN SMALL ARMS AMMUNITION

Fig. 25.

Three types of German Small Arms bullets are shown in Fig. 25. These consist of a :—

(*a*) s S cartridge.
(*b*) S m K cartridge.
(*c*) S m K L'spur cartridge.

A complete round consists of a cartridge case, percussion cap, propellant charge and bullet. The cartridge case may be either drawn from sheet brass (72 per cent. copper and 28 per cent. zinc) or from sheet steel, copper plated on both sides. The brass case is stamped S* on the base, the steel case with an " S " only.

The case is bottle shaped; it is grooved at the base and coned slightly externally to facilitate extraction. A cap chamber is formed in the base of the case and connected by flash channels to the interior. In the centre of the chamber an anvil is formed on which the cap composition is fired by the striker.

The percussion cap may be either No. 88 or No. 30. The No. 88 consists of a brass detonator containing detonating composition and a covering cap of double sided zinc-plated lead foil. The detonating composition is put into the detonator dry and protected from damp and flaking by the

cap which is lacquered on the inside. The inside of the detonator is also lacquered to the level of the detonating composition.

The No. 30 cap is generally similar to the No. 88 differing in having certain components which, in the case of the No. 88 cause severe erosion, replaced by others without these disadvantages.

The base of the case is stamped with the Firm's mark, *e.g.*, P = Polte, the mark of the case, *e.g.*, S*, the delivery number, *e.g.*, 6 = delivery 6 and the year of manufacture, *e.g.*, 31 = 1931.

The propellant charge in the cartridges here described consists of nitrocellulose in blackish, square graphite treated flakes of about 0·25 mm. thick and 1·2 to 1·5 mm. long with smooth cut surfaces.

The bullet for the s S cartridge is of 7·9 mm. calibre and is formed with a groove at the base by means of which it is secured in the cartridge case. It consists of a bullet envelope into which the core is pressed. The envelope is drawn from ingot steel, plated with tombax and the core is pressed from hard lead. The base is streamlined. This bullet is the same for rifle, carbine or machine gun.

The S m K cartridge differs from the above in the bullet being somewhat longer. It contains a steel core around which there is a thin lead jacket. It is specially designed for armour piercing.

The S m K L'spur cartridge differs from the S m K in having a tracer bullet. The core is shorter than the S m K and has a case containing the tracer composition placed behind it. The composition burns green and red or yellow. The trajectory is marked by the burning of the tracer composition and can be seen up to 900 metres. It is used chiefly for A.A.

Marking.—To protect the detonating composition and the propellant from damp the annulus of the cap is lacquered. The colour of the lacquer is Green for s S cartridge and Red for S m K or S m K L'spur cartridge. In addition the point of the tracer bullet S m K L'spur is blackened for a distance of 10 mm. from the tip.

Packing.—The packing of service cartridges is as follows :

5 cartridges in one clip.

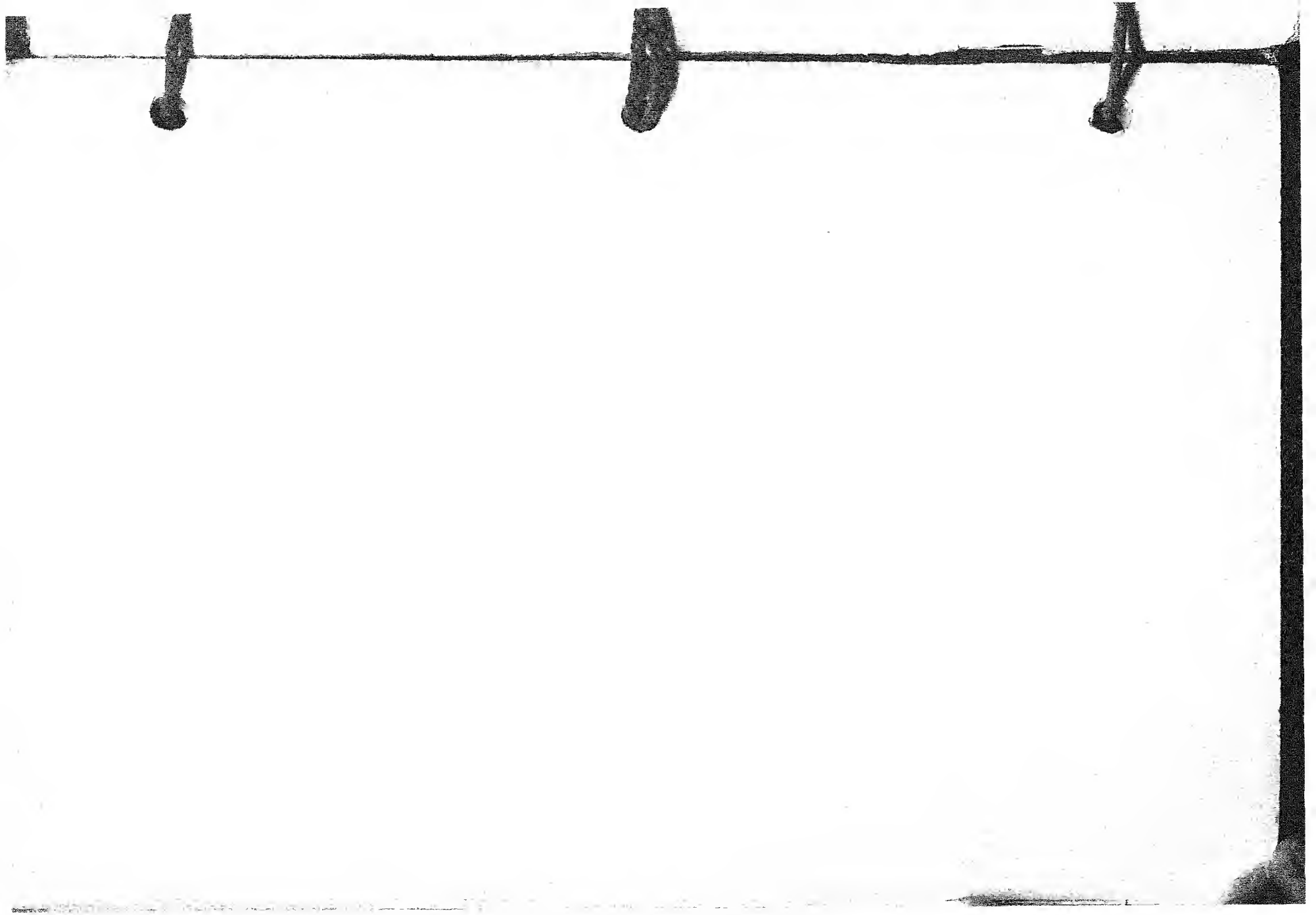
3 full clips in one folding box = 15 rds.

20 ,, folding boxes in one case = 300 rds.

5 ,, cases in one cartridge box = 1,500 rds.

A cartridge box filled with about 1,500 rounds weighs about 92·5 lb.

(393/4504) Wt. 27897—8883 4000 12/40 H & S Ltd. Gp. 393



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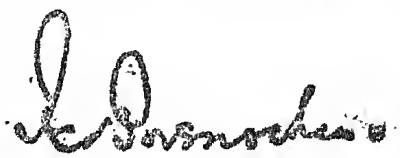
HANDBOOK OF ENEMY AMMUNITION

PAMPHLET No. 12

GERMAN GUN AND MORTAR AMMUNITION

By Command of the Army Council,



THE WAR OFFICE,
5th AUGUST, 1944.

LONDON:

Printed under the Authority of HIS MAJESTY'S STATIONERY OFFICE
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HANDBOOK

OF

ENEMY AMMUNITION

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German Ammunition

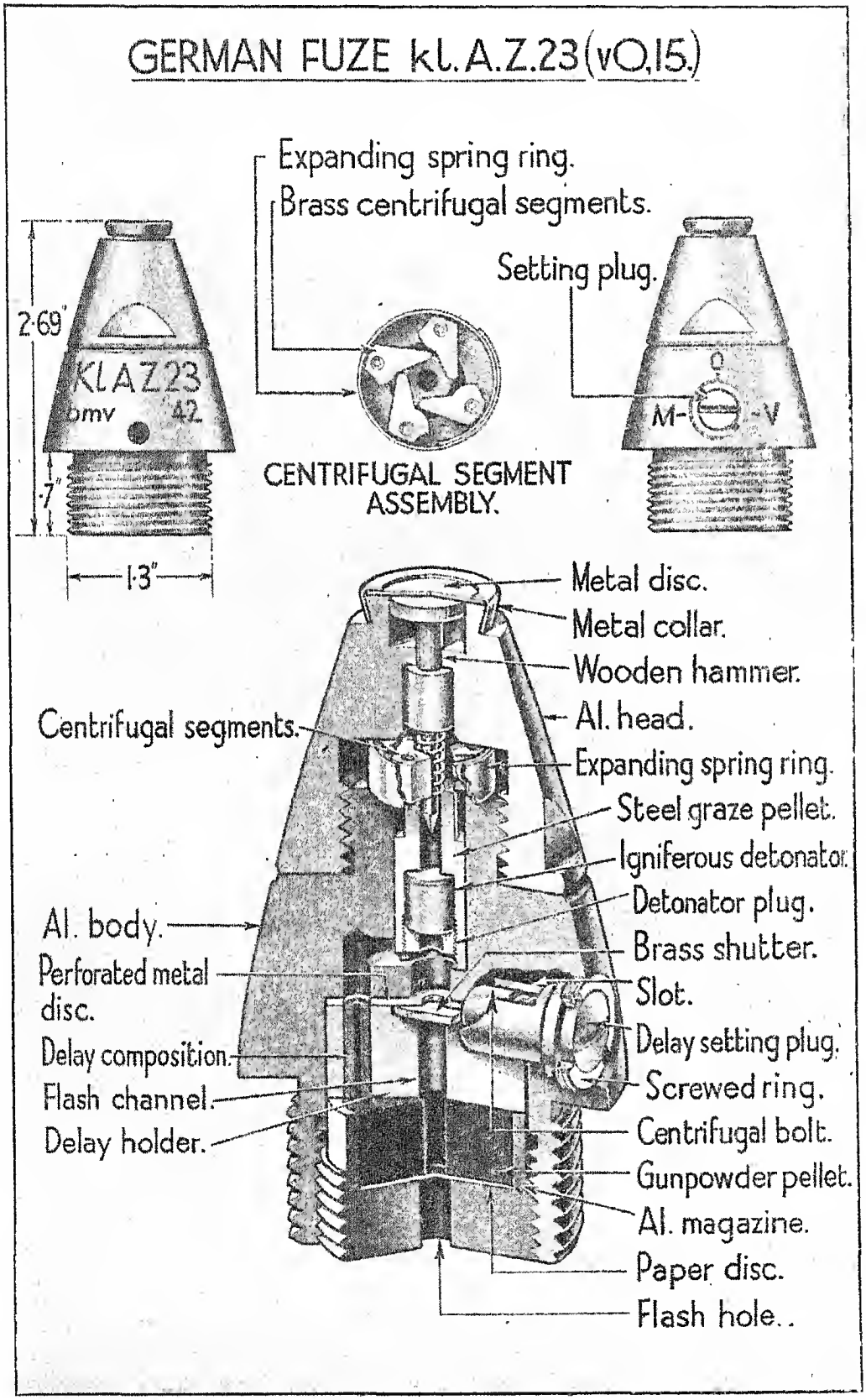

GERMAN FUZE kl.A.Z.23(vO.15.)
Expanding spring ring.
Brass centrifugal segments.
Setting plug.
2·69"
KLAZ23
bmv 42
·7"
1·3"
M-
-V
CENTRIFUGAL SEGMENT ASSEMBLY.
Metal disc.
Metal collar.
Wooden hammer.
Al. head.
Centrifugal segments.
Expanding spring ring.
Steel graze pellet.
Igniferous detonator.
Detonator plug.
Al. body.
Brass shutter.
Perforated metal disc.
Slot.
Delay setting plug.
Delay composition.
Screwed ring.
Flash channel.
Centrifugal bolt.
Delay holder.
Gunpowder pellet.
Al. magazine.
Paper disc.
Flash hole..

Fig. 1

This combined graze and direct action fuze with an optional delay of 0·15 or 0·2 second is a smaller size of the normal A.Z.23 and is used in H.E. shell for the following equipments :—

7·5 cm. Kw.K. (Tank gun).
Stu. G. 7·5 cm. K (S.P. assault gun).
7·5 cm. Geb. G.36 (Mountain gun).
7·5 cm. Kw. K.40 (Tank gun).
7·5 cm. Pak. 40 (Anti-tank gun).
7·62 cm. Pak. 36 (Anti-tank gun).

The weight of the fuze is 4 oz. 14 drs. and its dimensions compare with the A.Z.23 as follows :—

Fuze	*Protrusion*	*Intrusion*	*Diameter of screwthreads*	*Pitch of Threads*
k1.A.Z.23	1·99 inches	0·7 inches	1·3 inches	1·5 mm.
A.Z.23	3·75 ,,	0·65 ,,	1·96 ,,	3 mm.

The fuze differs from the k1.A.Z.23 Nb mainly in the addition of the optional delay arrangement and the magazine which contains a perforated pellet of gunpowder weighing approximately 53 grains.

The construction and action of the fuze, as shown in the drawing is the same as that of the normal A.Z.23 fuze.

GERMAN FUZE k1.A.Z.23 Nb WITH ENCASED PLASTIC BODY (k1.A.Z.23 Nb. (Pr))

(Fig. 2)

The fuze, as indicated by the letters " Nb " in the abbreviated designation, is intended for use in smoke shell but has also been found in H.E. shell for the anti-tank equipment 7·5 cm. Pak 40. The deep olive green painting of the exterior distinguishes this fuze, largely of moulded plastic with a steel casing, from the aluminium fuze of the same designation which is described with the 7·5 cm. smoke shell in Pamphlet No. 4.

The weight of the fuze is 5 oz. 2 drs. The dimensions are shown on the drawing.

The fuze body consists of a thin steel ogival casing attached by spot welding to an inner cylindrical steel casing both of which cover moulded brown plastic. The ogival casing has a hole at the top for the wooden hammer. The hole is closed by a brass disc overlapped by the casing. The cylindrical casing is inserted from the base of the ogival portion and attached about half way up the interior. The lower part of the cylinder protrudes and is screwthreaded for insertion in the shell. The plastic interior is in two parts. The larger part, forming the centre of the body, is shaped to accommodate the graze and direct action mechanism and has an interior screw-thread in the lower portion to receive the moulded plastic base

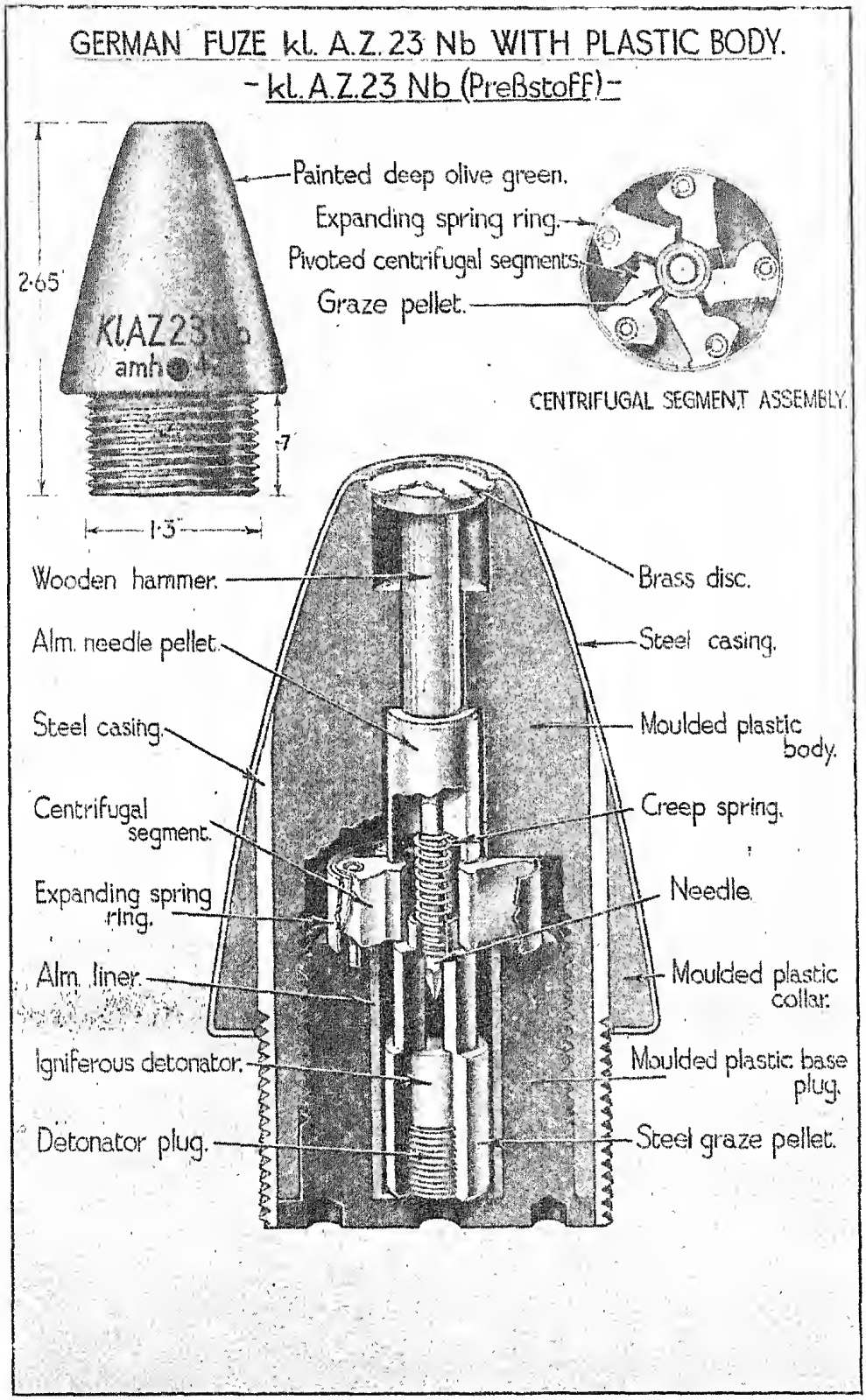

GERMAN FUZE kl. A.Z. 23 Nb WITH PLASTIC BODY.
- kl. A.Z.23 Nb (Preßstoff) -
Painted deep olive green.
Expanding spring ring.
Pivoted centrifugal segments.
Graze pellet.
CENTRIFUGAL SEGMENT ASSEMBLY.
2·65"
·7"
1·3"
Wooden hammer.
Alm. needle pellet.
Steel casing.
Centrifugal segment.
Expanding spring ring.
Alm. liner.
Igniferous detonator.
Detonator plug.
Brass disc.
Steel casing.
Moulded plastic body.
Creep spring.
Needle.
Moulded plastic collar.
Moulded plastic base plug.
Steel graze pellet.

Fig. 2

plug. The smaller part of the plastic interior is in the form of a collar which surrounds the cylindrical casing within the ogival portion.

The fuze mechanism consists of a steel graze pellet carrying an igniferous detonator below a needle fitted to an aluminium pellet. The needle pellet is recessed at the base and is held away from the graze pellet by a creep spring and by five pivoted centrifugal segments. The segments are held in engagement with a shoulder on the graze pellet by a spring in the form of an expanding ring and are pivoted on the top of the plastic base plug. The plug is recessed and fitted with an aluminium liner to contain the graze pellet and has a flash hole at the base.

Action

The coil of the expanding spring ring is enlarged and the segments swing clear of the graze pellet by centrifugal force during flight. The needle pellet is then held in the forward position by the " creep " resulting from deceleration and is protected from air pressure by the brass sealing disc in the top of the fuze. Forward movement of the graze pellet is prevented by the creep spring.

On graze, the graze pellet sets forward, overcoming the creep spring, and impinges the detonator on the needle. With suitable impact the needle is simultaneously driven towards the graze pellet and direct action is obtained. The flash from the detonator passes through the flash channel in the detonator plug, and through the flash hole in the base of the fuze to the gaine beneath. The recess in the base of the needle pellet is apparently designed to fit over the top of the graze pellet and thus prevents the flash being expended in the wrong direction.

GERMAN FUZE A.Z.23v. (0,15)

(Fig. 3)

The fuze has a combined graze and direct action with an optional delay of 0·15 second and is used in H.E. shell of equipments as follows :—

Equipment	*Shell*
F.K. 16n.A. (7·5 cm.)	K.Gr. rot.
le.F.K.18 (7·5 cm.)	K.Gr. rot.
le.F.H.16 (10·5 cm.)	F.H.Gr.
	F.H.Gr.38 Stg.
le F.H.18 and le F.H.18M. (10·5 cm.)	F.H.Gr.
	F.H.Gr.38 Stg.
	F.H.Gr.F.
10 cm. K.17 and 10 cm. K.17/04 n.A. (10·5 cm.)	F.H.Gr. rot.
s.10 cm. K.18 (10·5 cm.)	10 cm. Gr.19.
m.10 cm. K.K. and m.10 cm. K.T. (10·5 cm.)	10 cm. Gr.34.
10·5 cm. L.G.40	F.H.Gr.41.
15 cm. K.18, 15 cm. K.39, 15 cm. K.(E) and 15 cm. K. Mrs. Laf.	15 cm. K.Gr. 18.

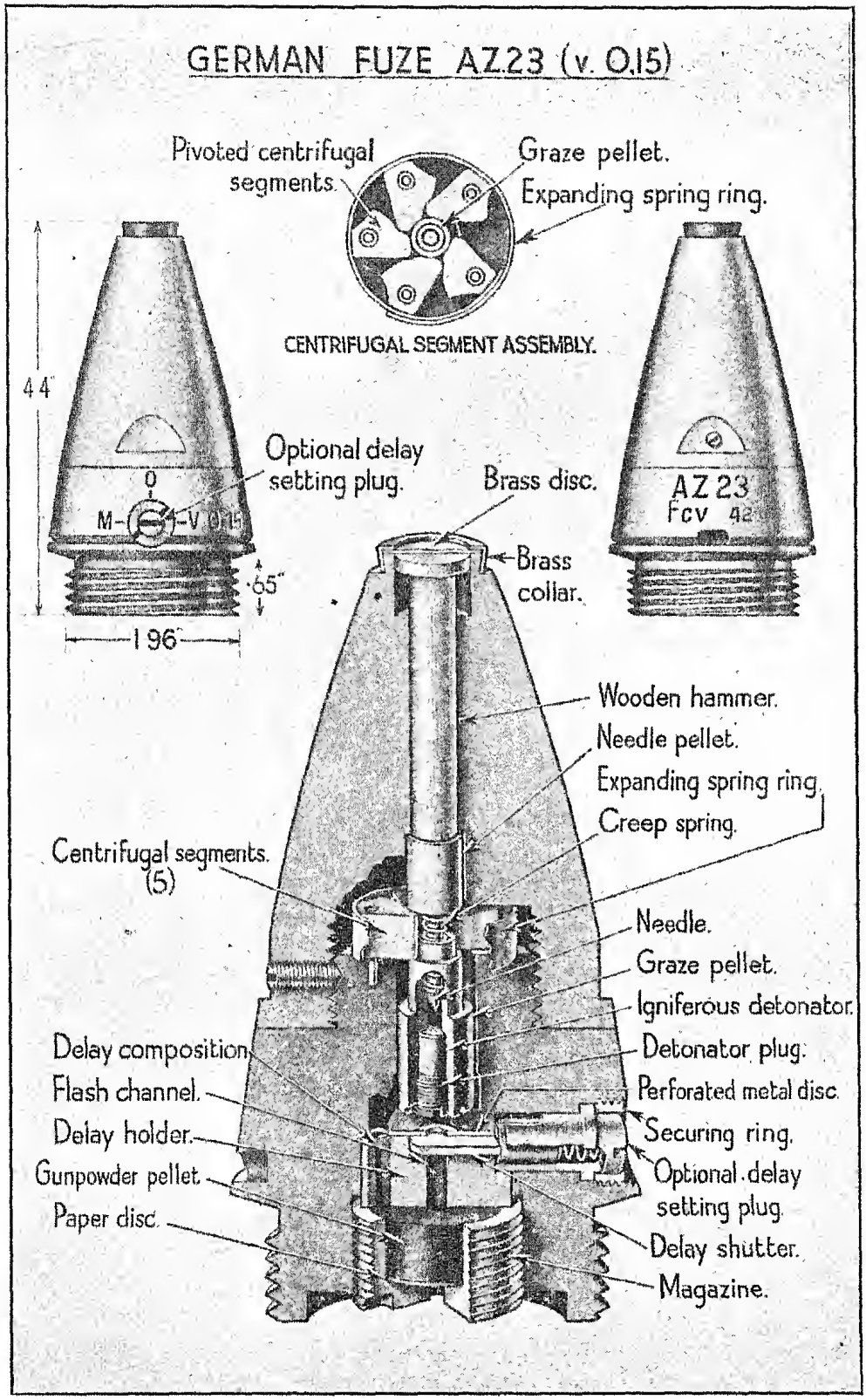

GERMAN FUZE AZ23 (v. O.15)
Pivoted centrifugal segments.
Graze pellet.
Expanding spring ring.
CENTRIFUGAL SEGMENT ASSEMBLY.
44"
Optional delay setting plug.
Brass disc.
Brass collar.
AZ 23
Fcv 42
·65"
1·96"
Wooden hammer.
Needle pellet.
Expanding spring ring.
Creep spring.
Centrifugal segments. (5)
Needle.
Graze pellet.
Igniferous detonator.
Detonator plug.
Perforated metal disc.
Securing ring.
Optional delay setting plug.
Delay shutter.
Magazine.
Delay composition.
Flash channel.
Delay holder.
Gunpowder pellet.
Paper disc.

Fig. 3

The designation "A.Z.23" is stamped above the flange of the aluminium body diametrically opposite to the optional delay setting plug. The period of delay is stamped adjacent to the plug in the form "V.0,15." To obtain delay the slot in the head of the setting plug is set coincident with the index marks lettered "M" and "V." For action without delay the plug is set to the "0" index."

The weight of the fuze is 15 oz. 6 drs. The dimensions are shown on the drawing.

The aluminium body of the fuze is in two parts. The head portion, which is screwed to the lower part, is solid and tapers towards the nose. A channel is formed through its centre to accommodate the wooden hammer and the needle pellet. The channel is closed against air pressure at the top by a brass disc which is secured by a brass collar fitted around a step formed in the nose of the fuze. The head is secured to the lower part by a fixing screw.

The lower portion of the body is tapered above the flange to correspond to the head and is screwthreaded below the flange for insertion in the shell. Near the top it is reduced in diameter and screwthreaded to receive the head and is recessed to accommodate the graze pellet. Another recess, formed in the base, contains the delay holder with a shutter and is screwthreaded to receive the magazine. The two recesses are connected by a central flash hole and an inclined flash channel. A radial channel for the optional delay assembly leads from the exterior to the lower recess.

The aluminium needle pellet, fitted with a steel needle, is supported above the graze pellet by a creep spring and by five centrifugal aluminium segments pivoted on the top of the lower portion of the body. The segments are held between the base of the needle pellet and a shoulder on the graze pellet by an expanding spring ring.

The graze steel pellet carries an igniferous detonator supported by a perforated screwed plug.

The delay holder consists of a cylindrical aluminium pellet with a flash channel through the centre and a second channel, displaced from the centre, which contains a delay filling and coincides with the inclined flash channel from the recess containing the graze pellet. A slot formed in the top of the holder to receive the shutter extends to just beyond the central flash channel. At the outer end of the slot the holder is recessed to receive the inner end of a centrifugal bolt forming part of the shutter. A tin disc with perforations corresponding to the channels in the holder is inserted above the holder.

The shutter assembly consists of a copper plate attached to a cylindrical bolt and is contained in the delay setting plug with a spiral spring which tends to retain the shutter in a position to close the central flash channel. The width of the shutter is greater than the diameter of the centrifugal bolt.

The delay setting plug is recessed from the inner end to accommodate the centrifugal bolt and the spiral spring and has two slots to receive the sides of the shutter projecting beyond the bolt. The outer end of the setting plug is closed and has a groove for the setting key. The plug is retained in the fuze body by a screwed securing ring which engages a flange on the plug but does not prevent it being turned in setting.

The magazine contains a pressed perforated pellet of gunpowder weighing approximately 2 drams and has a flash hole in the base closed by a paper disc.

Action

Before loading, the fuze is set for delayed or non-delayed action by means of the setting plug.

During flight the coil of the expanding spring ring is enlarged and the segments swung clear of the graze and needle pellets by centrifugal force. The needle pellet is then held in the forward position by " creep " whilst the graze pellet is held back by the creep spring. The action of the shutter is governed by the setting plug. With the plug set to " 0," the slots at its inner end are aligned with the projecting sides of the shutter and permit the centrifugal bolt to move outwards, taking with it the shutter and exposing the central flash channel in the delay holder. With the plug set in alignment with the " M " and " V " markings, the slots in its inner end are not in a position to receive the protruding sides of the shutter. The movement of the shutter and bolt is thus prevented and the shutter remains closed.

On graze, the graze pellet moves forward, compressing the creep spring, and impinges the detonator on the needle. With suitable impact, the hammer and striker pellet are driven in as the graze pellet moves forward and a more rapid action is obtained.

The flash from the detonator ignites the delay composition in the delay holder through the inclined flash channel and, if the shutter has opened, at the same time passes through the central flash hole and explodes the powder pellet in the magazine. With the fuze set for delay action, the central flash hole is masked by the shutter and the explosion of the magazine filling is brought about by the delay composition.

GERMAN FUZE A.Z.23/28 v.(0,1)

(Fig. 4)

This fuze is of the same construction, dimensions and weight as the normal A.Z.23 fuze with optional delay (*see* description of A.Z.23 v. (0,15) and Fig. 3 included in this pamphlet) but is fitted with a stronger spring between the graze and needle pellets instead

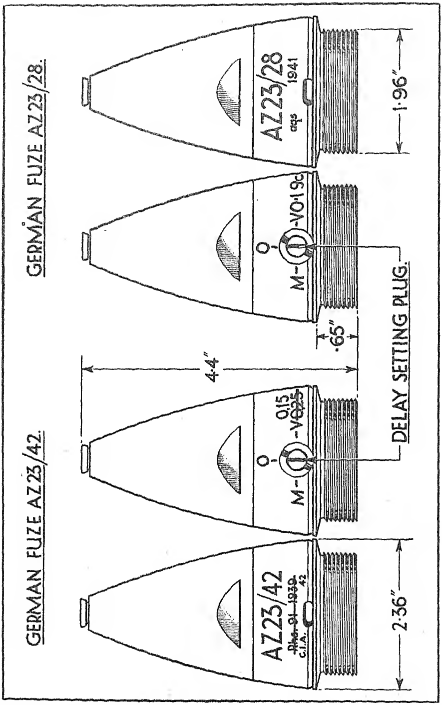


Fig. 4

Fig. 5

of the normal creep spring. The load required to bring the mechanism into the fired position is between 99 and 106 ounces as compared with a load of 16 to 19 ounces for the normal A.Z.23.

The fuze is identified by the designation " A.Z.23/28 " stamped above the flange where the time of the optional delay, 0·1 second, is also stamped.

The fuze is used in H.E. shell for the 8·8 cm. Flak 18, 36 and 41, (8·8 cm. multi-purpose guns), also for the 8·8 cm. Pak. 43 (anti-tank gun).

GERMAN FUZE A.Z.23/42 v. (0,15)

(Fig. 5)

This fuze is of the same construction, dimensions and weight as the normal A.Z.23 fuze with optional delay (*see* description of A.Z.23 v. (0,15) and Fig. 3 included in this pamphlet) but the centrifugal segments and the expanding spring ring encircling them are designed to arm at a lower rotational speed. The fuze is armed by centrifugal force at rotational speeds between 3,000 and 4,200 r.p.m. and the A.Z.23 v. (0,15) between 4,500 and 5,500 r.p.m.

The fuze is identified by the designation " A.Z.23/42 " stamped above the flange. The fuze examined had been stamped to indicate a delay of 0·25 second but this had been barred out and 0·15 stamped above. It is used with the H.E. shell for the 10·5 cm. Geb.H.40 (mountain howitzer).

According to a German document the fuze can also be used instead of the A.Z.23 v. (0,15) in every type of shell for the 10·5 cm. l.F.H.18 in which the latter is used.

GERMAN FUZE A.Z.23 umg 0,15

(Fig. 6)

The A.Z.23 umg fuzes differ externally from the A.Z.23 fuzes in having a much shorter coned head and are longer between the flange and the base. This lower part, which enters the fuze hole in the shell, has only a few screwthreads below the flange, the remainder being plain. Three types of the " umg " fuze have been found. These are :—

A.Z.23 umg 0,8.
A.Z.23 umg m.2V.
A.Z.23 umg 0,15.

The " 0,8 " fuze with an optional delay of 0·8 of a second, and originally used for 15 cm. Gr.19 for the 15 cm. medium howitzer s.F.H.18, is described in Pamphlet No. 1. This description was based on a French report. Fuzes of this type of later manufacture are made of steel with a rustproofed surface.

The " m.2V " fuze is also an optional delay fuze with two alternate delays. Details of the fuze are not yet available. Both this and the " 0·8 " fuze are being replaced by the " 0,15 " fuze.

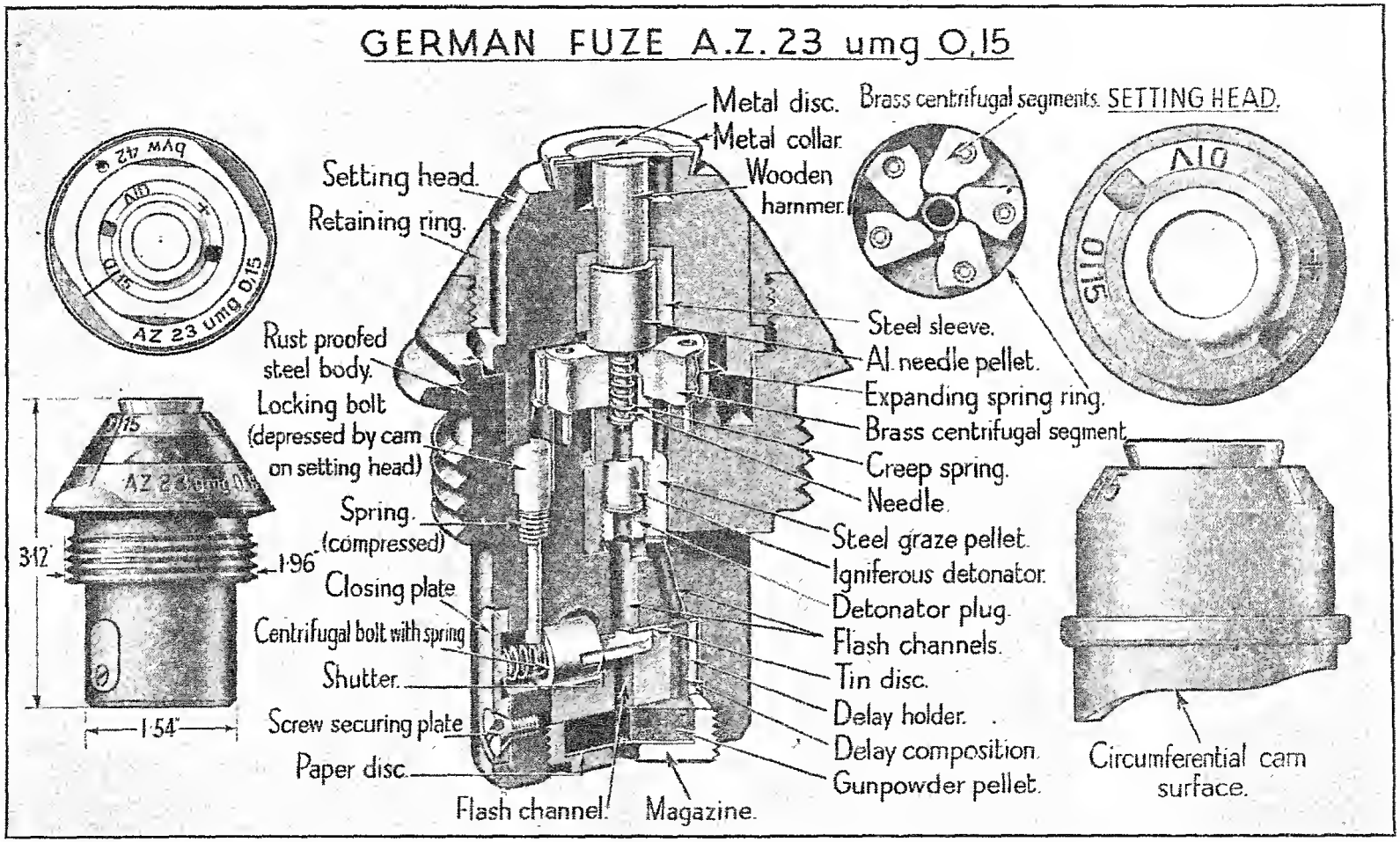

GERMAN FUZE A.Z. 23 umg 0,15
Metal disc.
Metal collar.
Wooden hammer.
Brass centrifugal segments.
SETTING HEAD.
Setting head.
Retaining ring.
Rust proofed steel body.
Locking bolt (depressed by cam on setting head)
Spring. (compressed)
Closing plate
Centrifugal bolt with spring
Shutter.
Screw securing plate
Paper disc.
Flash channel.
Magazine.
Steel sleeve.
Al. needle pellet.
Expanding spring ring.
Brass centrifugal segment.
Creep spring.
Needle.
Steel graze pellet.
Igniferous detonator.
Detonator plug.
Flash channels.
Tin disc.
Delay holder.
Delay composition.
Gunpowder pellet.
Circumferential cam surface.
3·12"
1·96"
1·54"
AZ 23 umg 0,15
A10
0115

Fig. 6
10

The " 0,15 " fuze with an optional delay of 0·15 of a second is here described and differs from the later type of " 0,8 " fuze only in the time of the delay.

Each of these fuzes can be identified by the designation stamped above the flange. The " m.2V " and more recently the " 0·15 " fuze are used in the H.E. shell, " 15 cm. Gr.19 " for the 15 cm. medium howitzer s.F.H.18 and in the H.E. shell " 21 cm. Gr.18 " for the 21 cm. howitzer 21 cm. Mrs. 18. The weight of fuzes of this type is approximately 1 lb. 10 oz. 2 drs.

The A.Z. umg 0,15 has the usual combined D.A. and graze mechanism consisting of a steel graze pellet carrying the detonator and an aluminium needle pellet held apart by a creep spring and five brass centrifugal segments encircled by an expanding spring ring. The graze pellet is contained in a central recess in the body which has two flash channels at the base. One channel leads direct to the magazine through an open channel in the delay holder, the other leads to the magazine through the delay composition in the delay holder. The needle pellet with a steel sleeve surrounding it and a wooden hammer above it is carried in the head of the fuze. The steel head is retained in the body by a retaining ring which screws into the top of the body and engages an external flange near the lower part of the head. The circumferential rim at the bottom of the head varies in depth to act as a cam which positions the spring loaded locking bolt of the shutter. Thus when the head is rotated to bring the deepest portion of the rim over the locking bolt the bolt is pressed down into the radial recess containing the shutter in the lower part of the fuze and prevents the shutter from opening. The setting positions of the head are marked on its protruding part by two lines at right angles which are set to an index line on the retaining ring and body. The setting line for delayed action is marked " MV " and that for " non-delay " " OV."

The delay holder, shutter assembly and magazine are all of the same type described for other fuzes of the A.Z.23 type.

Action

The fuze is set for " delay " or " non-delay " by turning the head to bring the appropriate setting marking into coincidence with the index line. When set to " MV " the locking bolt is pressed down by the deep part of the rim at the bottom of the head and locks the shutter in the closed position. When set to " OV " the short part of the rim is over the locking bolt thus permitting the bolt to be raised clear of the shutter recess by its spring.

During flight the coil of the expanding spring ring is enlarged and the segments swung clear of the graze pellet by centrifugal force. If set for " non-delay " the shutter is also thrown outwards and the open flash channel in the delay holder is exposed. Forward movement of the graze pellet is prevented by the creep spring.

GERMAN MORTAR FUZE. 36
(Wgr. Z. 36)

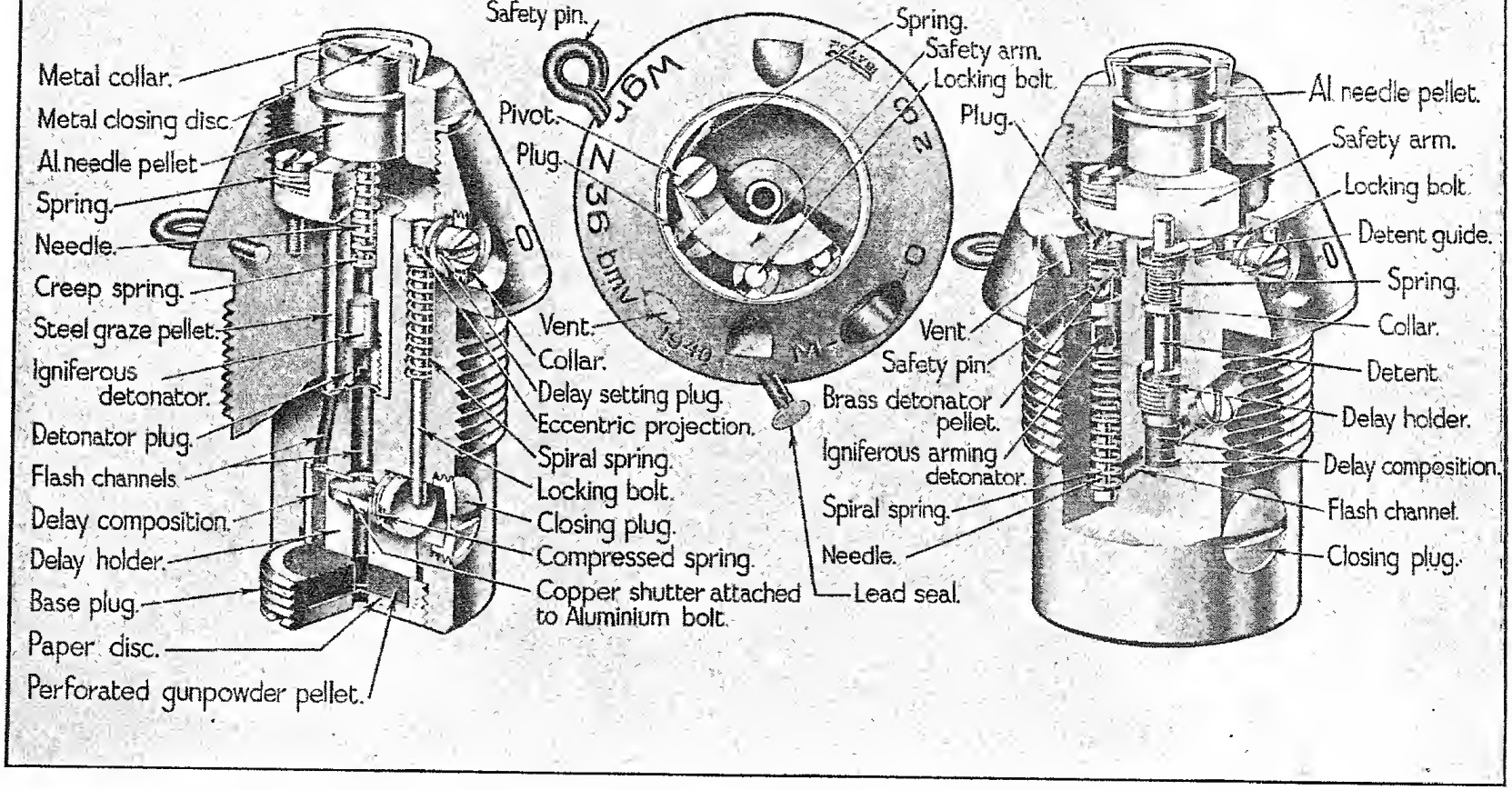


Fig. 7
12

On graze the detonator is carried forward by the graze pellet and pierced by the needle. When suitable impact is obtained the hammer and needle pellet are driven in as the graze pellet moves forward, thus accelerating the action. With the head set for " non-delay " the flash from the detonator passes direct to the magazine. If set for " delay " the open channel in the delay holder is masked by the shutter so the flash has to burn through the delay composition to reach the magazine.

GERMAN FUZE Wgr. Z.36

(Fig. 7)

This igniferous nose fuze, used with a gaine in the H.E. bomb fired from the 20 cm. light spigot mortar, is designed to arm in an unrotated projectile and has a combined graze and direct action with an optional delay. The arming device is operated by the burning of a delay composition which is ignited by a second detonator and delays the arming for a period of approximately 0·6 of a second after firing.

The body of the fuze is of aluminium alloy with a flat topped conical head which has the usual metal sealing disc at the top and is fitted with a safety pin secured by a lead seal. The abbreviated designation " Wgr. Z.36 " is stamped near the lower part of the coned head. On the opposite side of the head there is a delay setting plug inscribed with an arrowhead. Stamped in the head at one side of the plug is a graduation lettered " M ." On the opposite side a similar graduation is lettered " O." The arrowhead is set to the " M " graduation for delay or the " O " graduation for non-delay action.

The weight of the fuze is 6 oz.

The fuze body is recessed at the top to receive the needle pellet and safety arm and screwthreaded internally for the insertion of the closing cap. At the base of this recess four vertical recesses are formed. The central and largest recess contains the steel graze pellet and has two flash channels at the base. One of these channels is central, the other is displaced from the centre and is inclined. Of the other vertical recesses, two are formed side by side and are connected near the base ends by an inclined flash channel, which continues to the exterior of the body where it emerges at the screw-threaded portion and is closed by a screwed plug. One of these recesses contains a brass detonator pellet carrying a No. 37 igniferous detonator, the pellet being supported above a steel needle by a spiral spring and a safety pin. The pin is inserted through the head of the fuze and engages in a circumferential groove in the side of the detonator pellet. This recess is closed at the top by a screwed plug. The connected vertical recess contains, at its lower end, two small

pellets of delay composition beneath a sleeve filled with a similar composition. An inclined channel leads from the base of the recess to the head of the fuze where it is lightly closed by a metal disc secured by stabbing. The sleeve is of aluminium or aluminium alloy and is screwthreaded externally for insertion in the recess. A detent positioned above the sleeve is supported by the delay filling contained in the sleeve. The detent has a collar formed around its centre which supports a spiral spring held under compression between the collar and a screwed ring at the top of the recess. The upper end of the detent passes through the screwed ring and retains the safety arm in the safe position, i.e. partly covering the central recess which contains the graze pellet and closing the fourth recess. The fourth vertical recess has a channel at its base leading to a radial channel containing the shutter bolt in the lower part of the fuze. This recess contains a locking bolt for the shutter. The bolt is supported by a spring and has a collar formed near its head. The collar is engaged by an eccentric projection on the inner end of the delay setting plug which is contained in a radial channel in the head of the fuze. When the plug is set to the " M " graduation the eccentric projection, bearing down on the collar, pushes the locking bolt down into the shutter bolt channel and prevents the bolt moving outwards. When the plug is set to " O," the eccentric projection is raised and the locking bolt is free to be raised clear of the shutter bolt when the safety arm moves clear of the recess. The safety arm, in the form of a curved aluminium arm, is pivoted at one end where a spring is fitted which tends to swing it clear of the path of the graze and needle pellets and clear of the recesses containing the locking bolt.

The lower part of the fuze contains the shutter assembly, the delay holder and a magazine of gunpowder. The shutter assembly consists of a copper shutter attached to an aluminium bolt and a spiral spring which is fitted to the inner end of bolt and is under compression when the shutter is held in the closed position by the locking bolt. The delay holder is of the usual type used in German fuze and is in the form of a solid aluminium cylinder with a central flash channel with a groove for the shutter above it and a displaced channel containing delay composition. A perforated tin disc is placed over the holder and the shutter. The magazine screwed into the base of the fuze is in the form of cup shaped closing plug with a central flash hole and contains a perforated pellet of gunpowder. The flash hole is closed by a paper disc on the inner side.

Action

The safety pin is removed and the fuze set for delayed or non-delayed action before firing. If set for " delay " the locking bolt is held down to engage the shutter bolt by the eccentric projection on the setting plug. If set for " non-delay " the locking bolt is held down only by the safety arm.

On acceleration, the detonator pellet in the side recess sets back, compressing its spring, and the detonator is pierced by the needle. The flash passes through the connecting channel into the recess containing the delay composition and the detent. The pressure set up by the burning of the delay composition escapes by the inclined channel leading to the exterior of the head of the fuze. When the delay composition supporting the spring loaded detent has been destroyed, the detent is forced down by its spring and the safety arm is thus released. The arm is then swung clear of the graze and needle pellets and the recess containing the locking bolt by its pivot spring. If set for " non-delay " the locking pellet is then free to be raised by its spring and the shutter is released to be pushed out by its compressed spring to the open position. If set for " delay " the locking bolt cannot rise as it is held by the projection on the setting plug and the shutter remains closed leaving only the delay channel in the holder exposed. Forward movement of the graze pellet during the period of deceleration is prevented by the creep spring.

On graze the pellet overcomes the spring and carries the detonator on to the needle. When suitable impact is obtained, the needle pellet is driven in at the same time as the pellet moves forward and direct action results. The path of the flash from the detonator to the magazine is governed by the setting. If set for " delay " the central channel in the delay holder is closed by the shutter and the flash can pass only through the channel containing the delay composition. If set for " non-delay " the central channel is exposed and the flash passing by this route will be the first to reach the magazine.

Detonator and Delay Compositions

The detonator carried in the graze pellet is No. 26 which is in common use in German fuzes. The No. 37 detonator contained in the side recess has a layer consisting of mercury fulminate, potassium chlorate and antimony sulphide over a filling of black powder.

The delay compositions in the sleeve supporting the detonator and the pellets beneath the sleeve consist of the following :—

	Sleeve	*Pellet*
Nitrocellulose	3·9 per cent.	2·7 per cent.
Red lead	75·5 ,, ,,	72·0 ,, ,,
Silicon	20·6 ,, ,,	25·3 ,, ,,

The delay composition used in the channel in the delay holder has been found to be gunpowder in a fuze dated 1940. In a fuze dated 1941 a composition similar to that in the sleeve and pellets has been found. This composition has also been found in the delay holder of the A.Z.35K fuze described in Pamphlet No. 11.

GERMAN MECHANICAL TIME AND PERCUSSION FUZE S/90 K. (Dopp. Z.S/90 K)

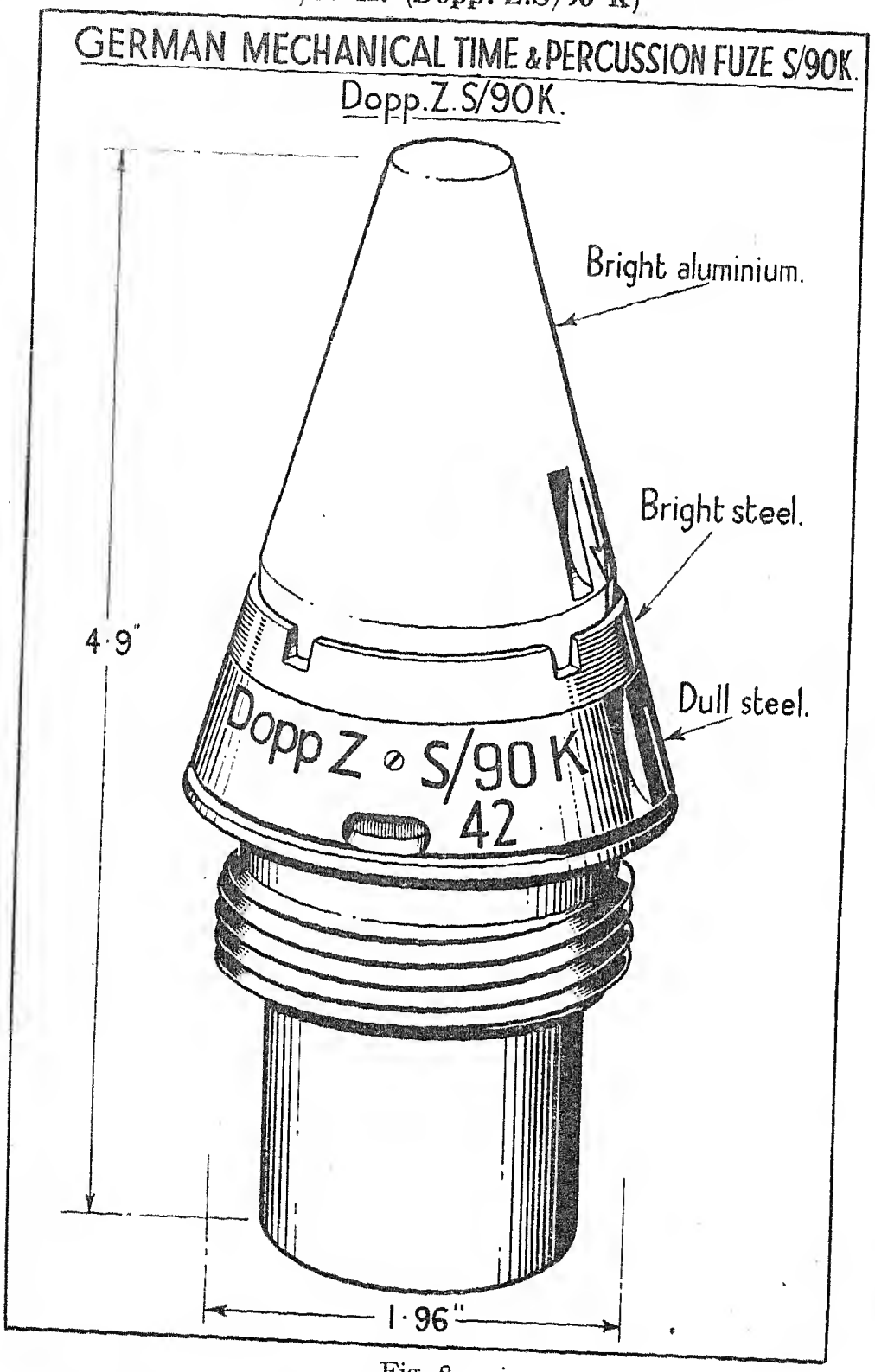


Fig. 8

The fuze has a mechanical time action with a maximum time of running of 90 seconds and a graze action of the normal German type. The construction and action are the same as described and illustrated for the Dopp. Z.S/90/45 in Pamphlet No. 11.

The fuze is used in the H.E. shell (K.Gr.39) and the H.E.B.C. shell (K.Gr.38 (Hb)) for the 17 cm. gun (17 cm. K. Mrs. Laf.).

The weight of the fuze is approximately 1 lb. 12 oz.

GERMAN BASE FUZE, SKODA B.Z.15

(Fig. 9)

Details of the filling of a gaine fitted to this fuze for use in the 3·7 cm. A.P.C. shell of Czech origin are shown on the drawing.

The fuze is described in Pamphlet No. 2, pages 6 and 7, and the shell in Pamphlet No. 9, page 19.

GERMAN BASE FUZE, SKODA 15 FOR 4.7 cm. Pak (t) AND Pak. K.36 (t) A.P.C. SHELL

(Fig. 10)

The fuze is used in the 4·7 cm. A.P.C. shell of Czech origin described in Pamphlet No. 10, page 29, and differs from that described for the 3·7 cm. A.P.C. shell in Pamphlet No. 2, pages 6 and 7, mainly in the addition of a delay sealing plug.

The steel needle pellet and creep spring are contained with the detonator in a cylindrical holder which is screwed into the base of the steel head of the fuze. The head contains the delay arrangement and, at its forward end, carries the gaine.

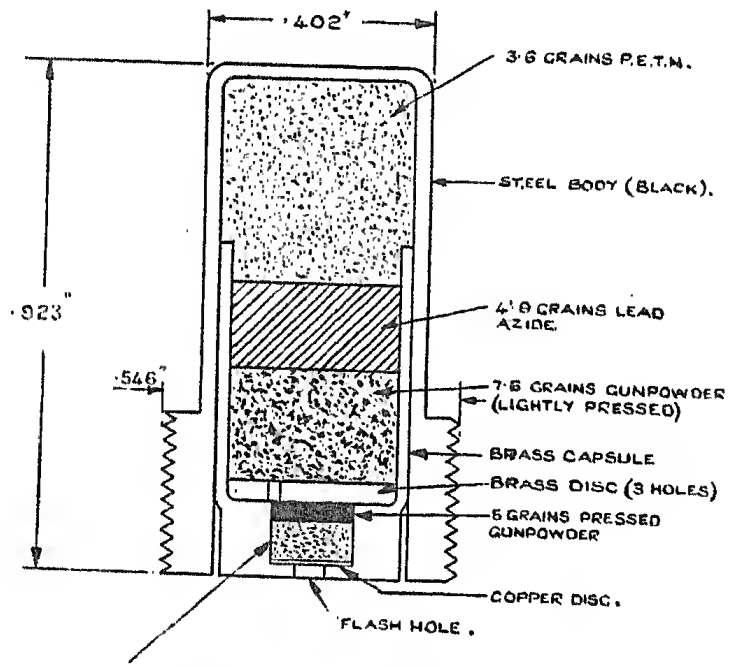
The delay arrangement consists of a sealing plug which closes the flash hole leading to the gaine and a filling of gunpowder which surrounds the plug. The cylindrical plug has a pintle and copper washer at the top to seal the flash hole and a flange near the base. The clearance between the flange and the wall of the recess in which the plug is contained is 0·015 inch. Below the flange there are four radial channels leading to a recess in the base of the plug.

Action

During flight the needle pellet, with the two locking balls, moves forward as the result of deceleration, until the balls are in a position to be thrown outwards by centrifugal force. The needle is then held off the detonator only by the creep spring.

On impact, the needle pierces the detonator and, at the same time, the sealing plug sets forward and seals the flash hole leading to the gaine. The flash from the detonator enters the recess in the base of the plug, and passing through the radial channels, ignites the

GERMAN BASE FUZE (SKODA B.Z. 15) ALTERNATIVE GAINE.



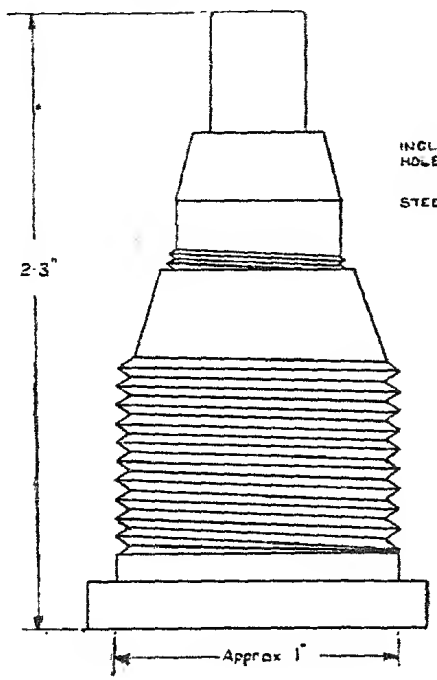
1 GRAIN DETONATOR COMPOSITION.

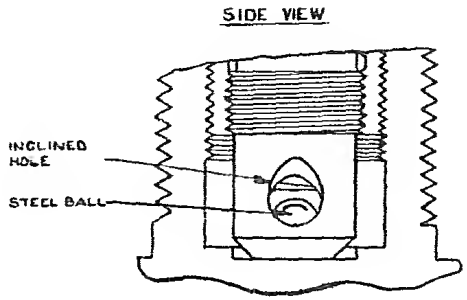
MERCURY FULMINATE	23·8%
POTASSIUM CHLORATE	43·2%
ANTIMONY SULPHIDE	32·0%
GRIT	1·0%

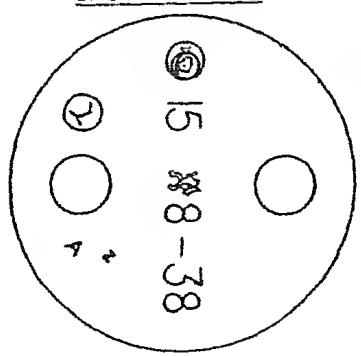
Fig. 9

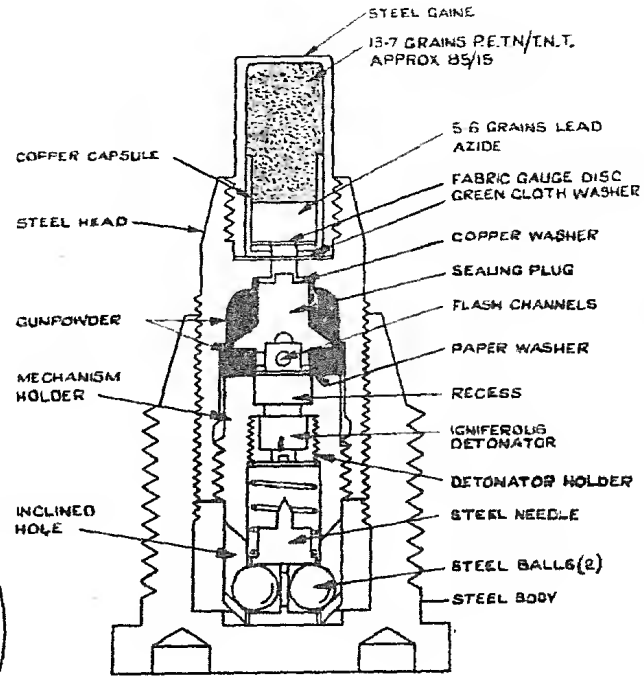
Fig. 10

GERMAN BASE FUZE (SKODA 15) FOR 4·7cm Pak (t) AND Pak K.36(t) APC SHELL.









gunpowder. The pressure set up by the ignition of the gunpowder behind the flange presses the plug firmly into the flash hole above. The combustion of the gunpowder leaves the pellet unsupported and leads to the ignition of the gunpowder in front of the flange, through the small clearance between the flange and the wall of the recess. The resultant pressure acting on the front of the flange pushes the sealing plug back into the recess in the forward end of the mechanism holder and thus opens the flash hole leading to the gaine.

GERMAN BASE FUZE Bd. Z.5127

(Fig. 11)

This is a base fuze fitted with a tracer and is used in the A.P.C.B.C. shell for the 8·8 cm. Flak 41 multiple purpose gun and for the 8·8 cm. Pak 43 anti-tank gun. The weight of the fuze with tracer is 11¾-oz. The tracer alone weighs ¾ oz. The fuze body is approximately 2·3 inches long, and screwthreaded externally at one end for insertion in the shell. The interior is divided into two compartments by a diaphragm formed in the body. The rear compartment contains the tracer and is rather smaller than that in the front which is screwthreaded internally and contains the fuze mechanism.

The fuze mechanism consists mainly of a tubular mechanism holder having at its rear end a fixed pellet containing a detonator and at its front end a striker with compressed spiral spring, two steel balls and an inertia collar.

The tubular holder is screwthreaded externally for approximately two thirds of its length from the base, its forward end is slightly less in diameter and is surrounded by a loose fitting inertia collar secured by a shear wire. The base of the holder is closed by a cup-shaped pellet containing an igniferous detonator. Nearer the forward end of the holder are two radial channels diametrically opposite and closed on the outside by the inertia collar.

Two steel balls are held partially in the channels and partially in two recesses in the body of the striker thereby holding the latter off the detonator. One end of the striker spring, which is held under compression, bears against a shoulder in the channel at the forward end of the holder whilst the other end fits into the cup-shaped body of the striker. Two flash holes are formed in the base of the striker body on diametrically opposite sides of the needle.

The front end of the fuze body is closed by a gaine containing cyclonite over lead azide and lead styphnate.

Action

On impact, the inertia collar sets forward and breaks the shear wire thereby allowing the steel balls, under centrifugal action, to move outwards and unlock the striker. The striker under the action of its spring is forced back on to the detonator. The flash from the

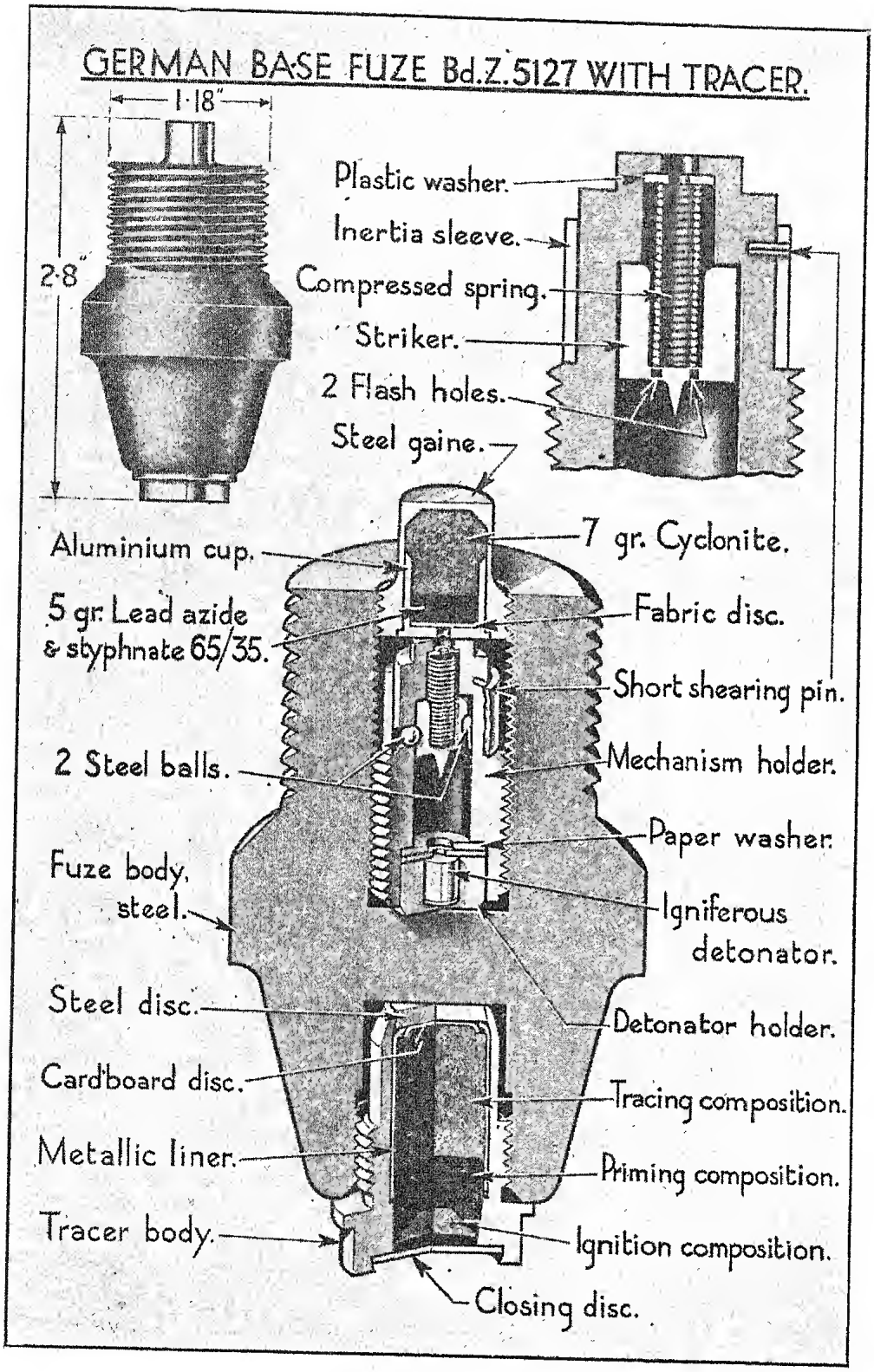

GERMAN BASE FUZE Bd.Z.5127 WITH TRACER.
1·18"
2·8"
Plastic washer.
Inertia sleeve.
Compressed spring.
Striker.
2 Flash holes.
Steel gaine.
Aluminium cup.
5 gr. Lead azide & styphnate 65/35.
2 Steel balls.
Fuze body, steel.
Steel disc.
Cardboard disc.
Metallic liner.
Tracer body.
7 gr. Cyclonite.
Fabric disc.
Short shearing pin.
Mechanism holder.
Paper washer.
Igniferous detonator.
Detonator holder.
Tracing composition.
Priming composition.
Ignition composition.
Closing disc.

Fig. 11

detonator passes through the flash channels on either side of the striker to the gaine at the forward end of the fuze.

GERMAN SMOKE BOX NO. 11 FOR H.E. SHELL
(Rauchentwickler Nr. 11)

The box consists of a bakelized cardboard cylindrical container, 4 inches long and 1 inch in diameter, closed at the bottom with a yellow disc of heavily bakelized paper. The top is closed with a red plastic cap fitted inside the container. The composition weighs 76·05 grams (approximately 2 oz. 11 drs.) and consists of :—

Red phosphorus	85·4 per cent.
Paraffin wax	11·6 per cent.
Magnesium phosphates	2·9 per cent.

The smoke box examined had the marking " 3 KOLA 3976 " arranged in three lines on the top and " KOLA " at the base.

GERMAN, PRIMER, ELECTRIC, Q.F. AND MORTAR CARTRIDGES, C/23
(Fig. 12)

This is a smaller model of the C/22 electric primer described in Pamphlet No. 4, page 31, and is used in the cartridge for the 20 cm. light spigot mortar and in the fixed Q.F. cartridge for the 3·7 cm. Kw.K. (Tank gun). The primer corresponds to the percussion primer C/13 in dimensions and is identified by the designation " C/23" stamped in the base. The contact plug is visible in a chamfered hole in the base.

The brass body has two key flats formed at the base and is screwthreaded for insertion in the cartridge. The diameter over the threads is ·52 inch and the threads 18 to the inch.

The brass contact plug, contained inside the lower part of the body, is cylindrical in shape with a stem at the bottom which emerges through a chamfered hole in the base of the body for contact with the firing mechanism. A small lug is formed near the top of the plug which fits into a recess in the body to prevent rotation. A layer of light brown insulating composition coats the side wall of the plug including the stem and the greater part of the top. The top of the plug is recessed to contain gunpowder and the electric fuze head which extends radially across the plug. The fuze head consists of an upper and a lower contact strip with insulating material between them and a bridge wire at one end surrounded by a blob of ignition composition. The lower strip is in contact with the top of the contact plug whilst the upper strip is in contact with a projection inside the brass contact washer assembled above, but insulated from, the plug. The washer, in addition to this projection, has two external projections or lugs which engage in recesses inside the body

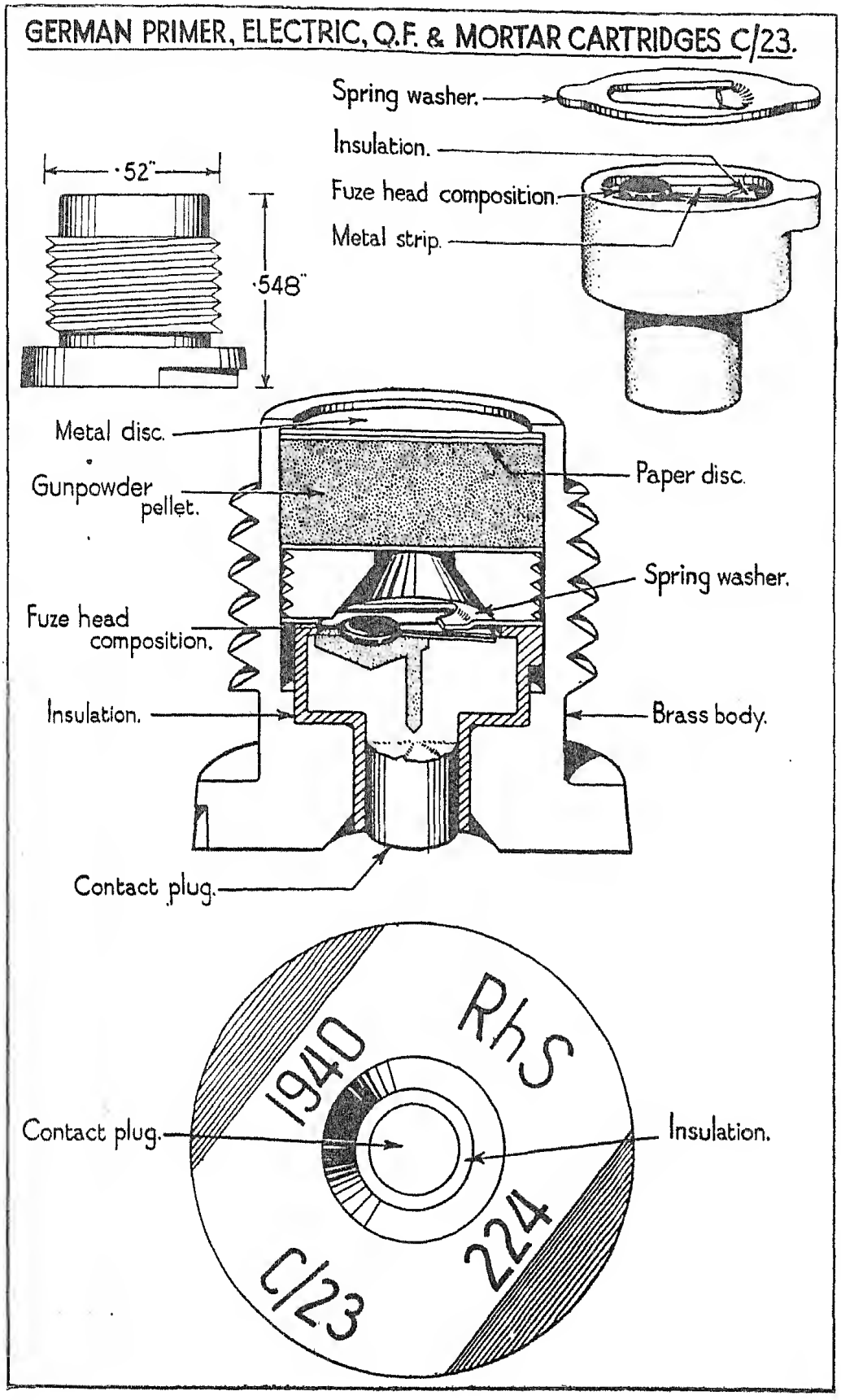

GERMAN PRIMER, ELECTRIC, Q.F. & MORTAR CARTRIDGES C/23.
Spring washer.
Insulation.
Fuze head composition.
Metal strip.
·52"
·548"
Metal disc.
Gunpowder pellet.
Paper disc.
Spring washer.
Fuze head composition.
Insulation.
Brass body.
Contact plug.
1940
RhS
Contact plug.
Insulation.
224
C/23

Fig. 12

and prevent rotation. A screwed plug with a central flash hole and a concave underside is screwed into the body to secure the contact washer and cover a priming of gunpowder surrounding the fuze head. The magazine in the top of the primer contains a pellet of gunpowder and is closed by a thin metal disc. The weight of the pellet is approximately 7 grains.

The path of the firing current is from the firing mechanism, through the contact plug to the lower strip of the fuze head, through the bridge wire to the upper strip thus heating the wire and igniting the composition and thence by the contact washer, through its inner projecting piece, through the body to earth.

GERMAN 5 cm. MORTAR CARTRIDGE 39 WITH FULL CHARGE—5 cm. Wgr. Patr.39 (gr. Ldg)

(Fig. 13)

The cartridge is used with the H.E. bomb (5 cm. Wgr.36) described in Pamphlet No. 4 and is identified by the marking " 5 cm. 39 " at the base. The base is lacquered green to indicate the full charge. A similar cartridge with a reduced charge, the " 5 cm. Wgr. Patr 39 (kl. Ldg) " has a red base.

The cartridge is used without augmenting cartridges and is of the usual primary type for mortars. The rolled paper body is green and the typical 28 bore sporting cartridge base is brass plated. The dimensions are shown on the drawing.

Body

The rolled paper body is lacquered externally and is fitted with a lining tube also of rolled paper. The body is closed at the mouth by a cardboard wad which is held by the rim being turned inwards. At the base the body is strengthened by a steel liner in the form of a cup fitting externally over the end. The steel liner is covered by a copper liner which extends further up the body and is in turn covered by a brass-coated copper shell which forms the base. A wad of rolled black paper holds the cap chamber in the body within the metal liners.

Cap

The cap chamber is of steel with a coating of copper and contains a brass cap in its lower part. The cap contains a brass anvil and a 0·73 grain filling consisting of :—35 per cent. of lead styphnate, 4 per cent. of tetrazene, 43 per cent. of barium nitrate, 6 per cent. of antimony sulphide and 12 per cent. of calcium silicide. The cap rests on a soft copper foil disc which closes the base of the cap chamber. The base is lacquered green.

Propellant Charge

The propellant charge of nitrocellulose powder consists of a priming charge of cylindrical grains in the lower part of the body and

GERMAN 5 cm MORTAR CARTRIDGE WITH FULL CHARGE
5cm Wgr Patr 39 (gr Ldg.)

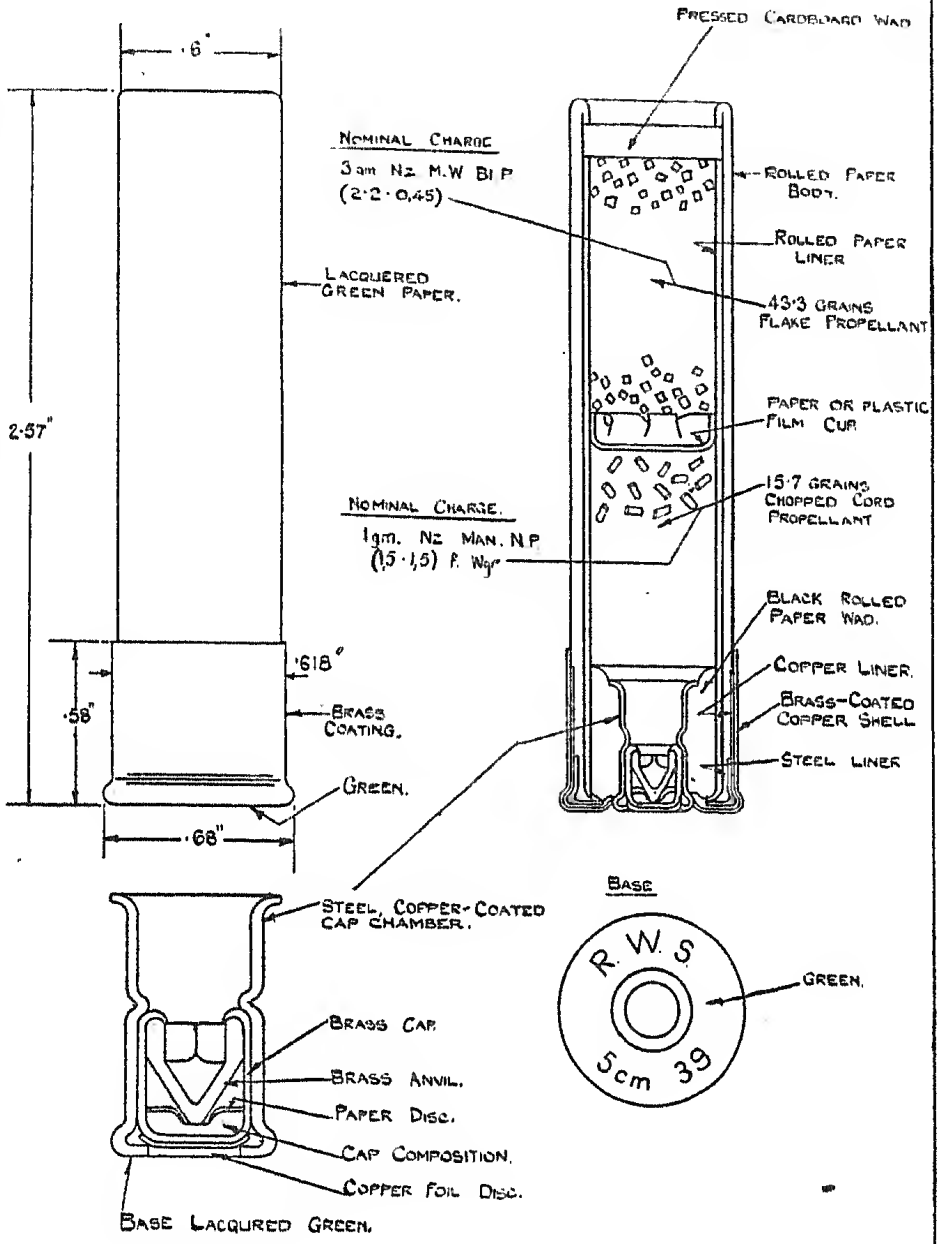


Fig. 13

a main charge of a square flake in the upper part. The two charges are separated by a paper or plastic film cup.

The priming charge has a nominal weight of 1 gram and the propellant is designated "Nz.Man.N.P.(1,5·1,5) f.Wgr.". In the cartridge examined the charge weighed 15·7 grains. The propellant, in the form of pale grey-green, porous chopped cords, with graphite incorporated, has the following composition :—Nitrocellulose plus graphite 95·3 per cent., diphenylamine 1 per cent., potassium sulphate 1·1 per cent. and included 2·6 per cent. of volatile matter. The nitrogen content of the nitrocellulose is 13·1 per cent.

The main charge has a nominal weight of 3 grams and the propellant is designated "Nz.M.W.Bl.P.(2.2.0,45)." In the cartridge examined, the charge weighed 43·3 grains. The square flake propellant, lightly coated with graphite, has the following composition :—Nitrocellulose (nitrogen content 13 per cent.) 98·1 per cent., diphenylamine 0·6 per cent. and included 1·3 per cent. of volatile matter.

Both propellants burn at a faster rate than that of Ballistite B.16 and the cartridge should, therefore, be efficient under wet weather conditions.

GERMAN 5 cm. MORTAR H.E. BOMB 36 WITH FUZE Wgr. Z.38. (5 cm. Wgr. 36 m. Wgr. Z.38)

(Fig. 14)

The following details are additional to those given in Pamphlet No. 4 :—

Bomb

The lower portion of the cavity for the bursting charge, where the tail unit is screwed into the body, is sealed by a coating of bitumen followed by a pad of magnesium oxychloride cement.

Bursting Charge

The T.N.T. bursting charge is a cast filling with a density of 1·60 and a setting point of 80·4 degrees centigrade. The weight of the charge in a bomb recently examined was 3·5 oz.

Gaine

The gaine, carried in an aluminium exploder container which is screwed to the lower portion of the fuze, is a Kl.Zdlg.34 Np. This small gaine, filled P.E.T.N./Wax, is described in Pamphlet No. 11.

Fuze

The igniferous detonator, fitted in the base of the fuze, consists of a cylindrical copper shell closed at the head and base by a thin copper disc and containing a detonator composition over a 0·06 grain filling of gunpowder. The detonator composition weighs ·3 grains and consists of :—potassium chlorate 51 per cent., antimony sulphide 24·1 per cent, and calcium silicide and glass 24·9 per cent.

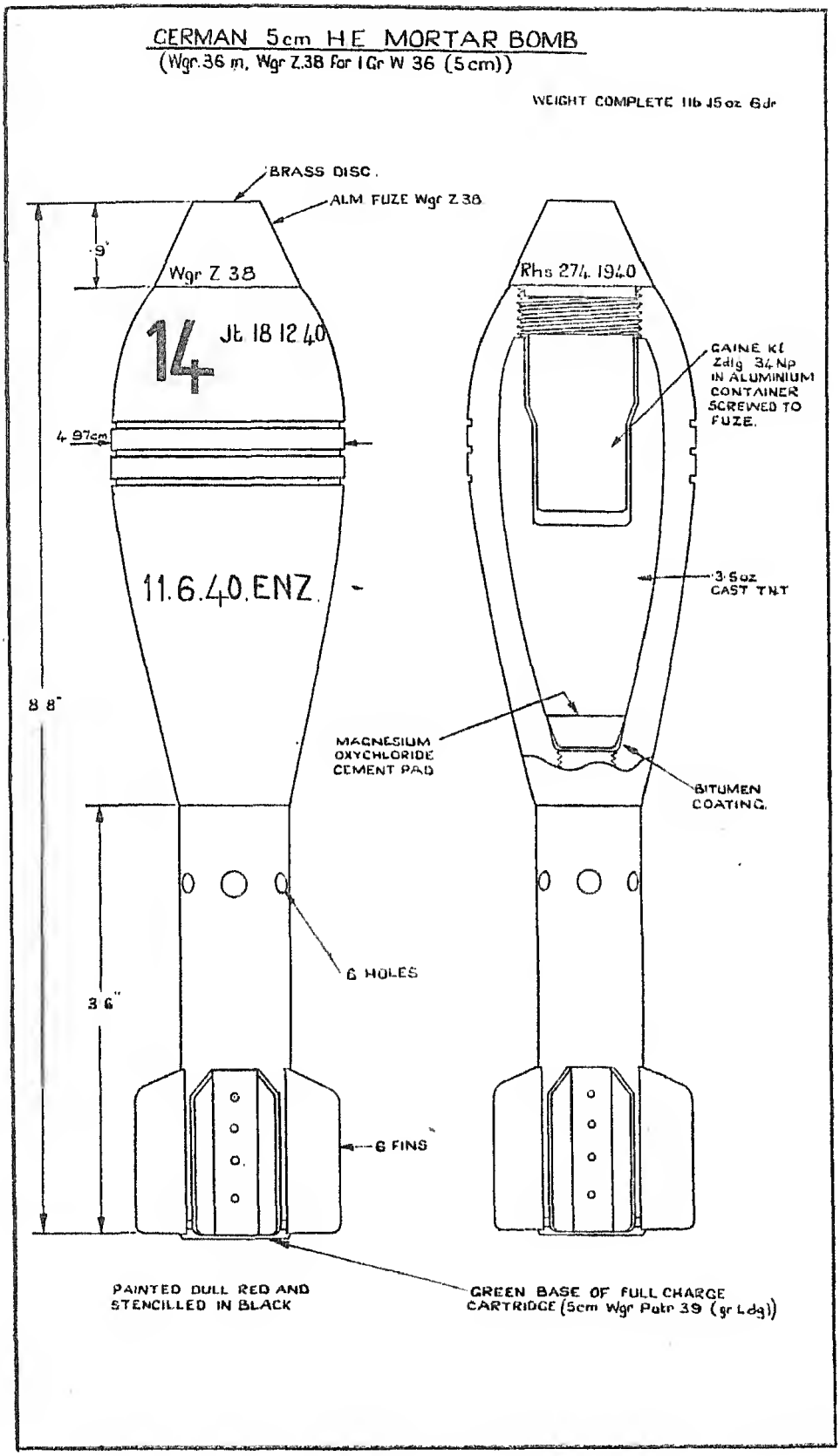

GERMAN 5cm HE MORTAR BOMB
(Wgr.36 m, Wgr Z.38 for 1Gr W 36 (5cm))
WEIGHT COMPLETE 1lb 15oz 6dr
BRASS DISC.
ALM FUZE Wgr Z 38
9"
Wgr Z 38
14 Jt 18 12 40
4.97cm
11.6.40.ENZ.
8 8"
3 6"
6 HOLES
6 FINS
PAINTED DULL RED AND STENCILLED IN BLACK
Rhs 274. 1940
CAINE Kl Zdlg 34 Np IN ALUMINIUM CONTAINER SCREWED TO FUZE.
3·5oz CAST TNT
MAGNESIUM OXYCHLORIDE CEMENT PAD
BITUMEN COATING.
GREEN BASE OF FULL CHARGE CARTRIDGE (5cm Wgr Patr 39 (gr Ldg))

Fig. 14

GERMAN 10·5 cm., H.E. STREAMLINED SHELL FUZED A.Z.23 OR DOPP. Z.S/60s. (10 cm. Gr. 19)

(Fig. 15)

The shell is used in the 10·5 cm. medium gun " s.10 cm. K.18 " with the mechanical time and percussion fuze " Dopp. Z.S/60s " (described in Pamphlet No. 10) or with the combined D.A. and graze fuzes, with optional delay, " A.Z.23 v. (0,25) " or " A.Z.23 v. (0,15) " The fuze with 0·25 second delay is described in Pamphlet No. 1. A description of the fuze with 0·15 second delay is included in this pamphlet. The shell is also used in the long 10·5 cm. turret gun " lg. 10 cm. K.T." with the " Dopp.Z.S/60s " fuze.

The body of the shell is painted the normal deep olive green, is stencilled in black and has two driving bands. The stencilling includes the H.E. numeral near the nose (" 13 " indicating amatol 40/60 and " 14," cast T.N.T.), the weight class in Roman numerals at the shoulder and the smoke box marking below the shoulder (R.11 indicates the inclusion of smoke box No. 11). The smoke box marking is omitted in some instances although this component is present.

The fuzed shell is 19·1 inches in length and weighs 33 lb. 9 oz. 8 dr. when filled and fuzed. Each of the fuzes used has a protrusion of approximately 3·7 inches.

Shell

The shell is in two parts, the head being screwed into the body about half way up the ogive. The body is of forged steel and is fitted with two copper clad driving bands of iron. The cavity in the upper part of the body is cylindrical. In the lower part it tapers towards the base and is machined. The head is a machined forging and is screwthreaded internally at the nose for the insertion of an adapter fitted with an exploder container and for the fuze. The exploder container is of mild steel. The weight of the empty shell is 26 lb. 2 oz. 6 drs. The diameter at the shoulder is 4·11 inches (10·44 cm.).

Method of Filling

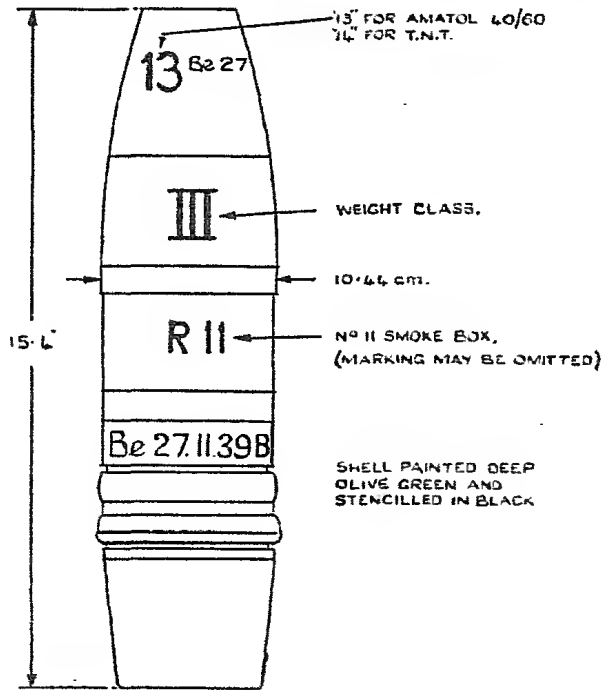
The bursting charge consists of cast T.N.T. or amatol 40/60 with a cavity below the fuze hole which contains a No. 11 smoke box beneath the exploder container. The weight of the amatol 40/60 bursting charge in a shell examined was found to be 3 lb. 12 oz. 15 drs.

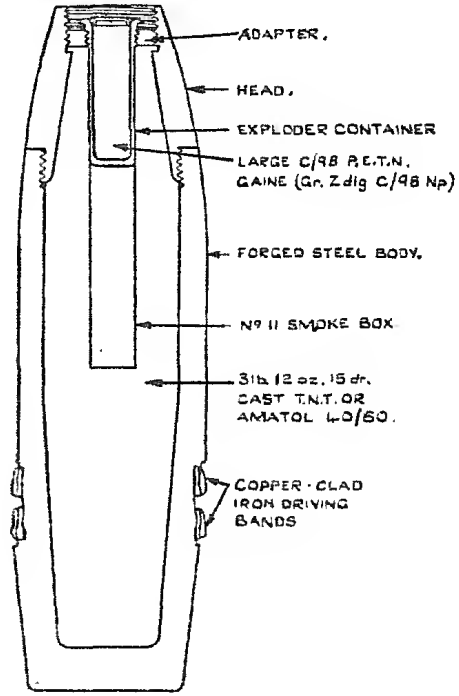
The smoke box, Rauchentwickler Nr. 11 is described as a separate item in this pamphlet.

The gaine in the exploder container is the larger size of the C/98 model with a filling of P.E.T.N./Wax (Gr. Zdlg. 3/98 Np). Details of the gaine are included in Pamphlet No. 6.

Fig. 15

GERMAN 10·5 cm. H.E., STREAMLINED SHELL FUZED A.Z. 23 OR DOPP. Z. S/60s.
(10 cm Gr. 19 for s 10 cm K.18 or l. 10 cm K.T.)





GERMAN 17 cm. K. Mrs. Laf. Q.F. CARTRIDGE

(Figs. 16 and 17)

The cartridge is used in the 17 cm. K. in Mrs. Laf. (17·25 cm. gun mounted on the 21 cm. high angle semi-mobile carriage) and consists of the case with the percussion primer of the C/12 type and the propellant charge in five sections. Only one of the sections (the Haupkart) is contained in the case when packed, the remainder being packed in metal cylinders. The sections provide four charges but are marked with abbreviated designations instead of the usual charge section numerals. These markings are also found on the packages. The designations used are as follows :—

Section 1. Sonderkart. 1.
Section 2. Sonderkart. 2.
Section 3. Haupkart.
Section 4. Vorkart. 3.
Section 5. Vorkart. 4.

The combinations of sections to provide the four charges are as follows :—

Charge 1. Sonderkart. 1 in the case alone.

Charge 2. Sonderkart. 1 with Sonderkart 2 extending down one side. Both sections in the case.

Charge 3. Vorkart. 3 loaded into the front of the chamber and followed by the Haupkart contained in the case.

Charge 4. Vorkart 3 with Vorkart 4, contained in its central tube, loaded into the front of the chamber and followed by the Haupkart contained in the case.

Charges 1 to 3 (inclusive) are used with the H.E. streamlined shell " Gr.39 " fuzed with the A.Z.35K or Dopp. Z.S/90K fuzes. Charge 4 is used with the H.E.B.C. streamlined shell " Gr.38 (Hb) " fuzed with the Hb.gr.Z.35K or the Dopp. Z.S/90K fuzes.

The case is stamped at the base with the model number 6342 and the designation of the equipment, " 17 cm. K.Mrs.L."

Propellant Charge

The propellant is of the Digl. double base type consisting basically of diethylene glycoldinitrate and nitrocellulose. The weight, nature and size used in the sections, as indicated by the markings, are :—

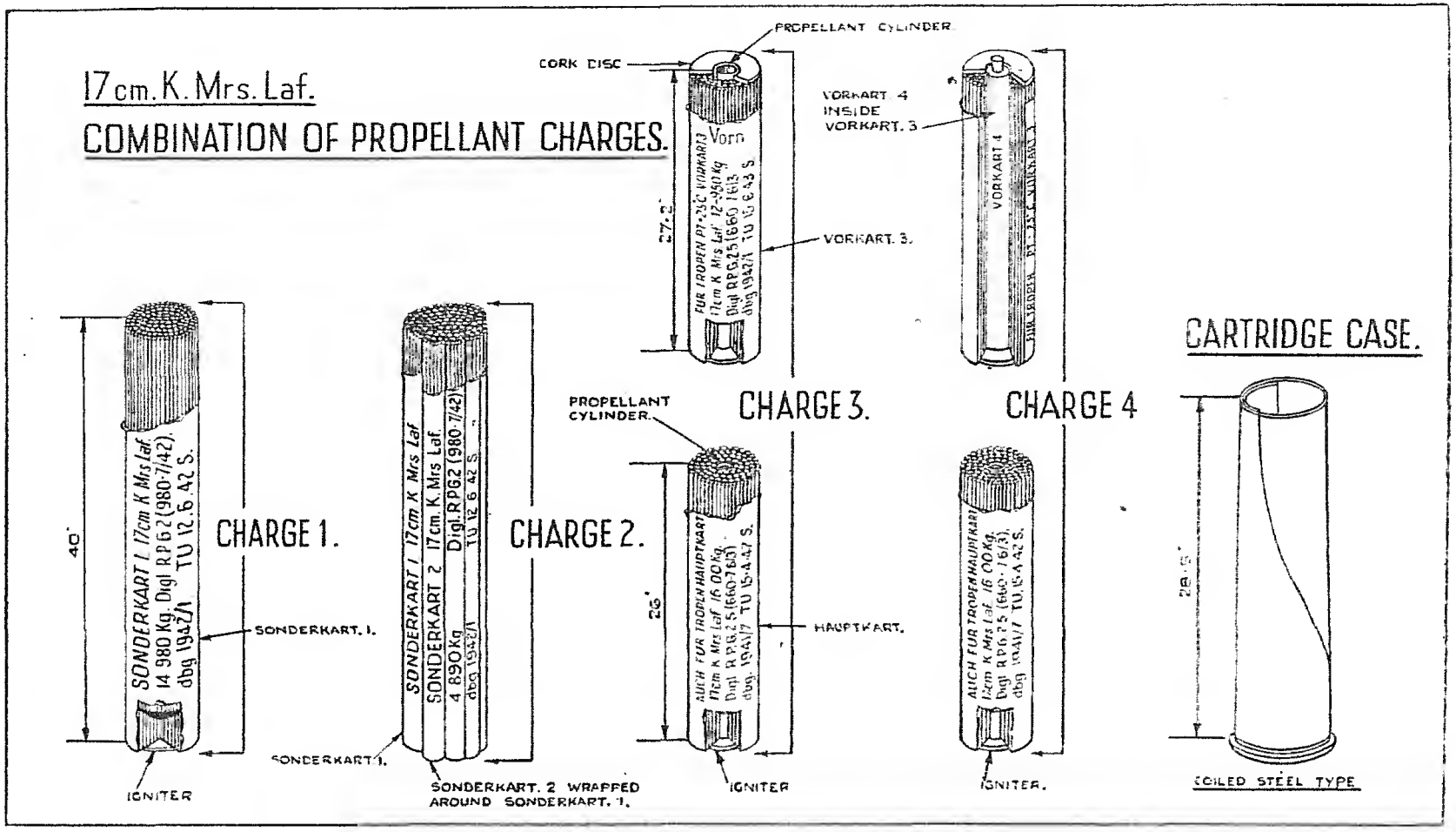
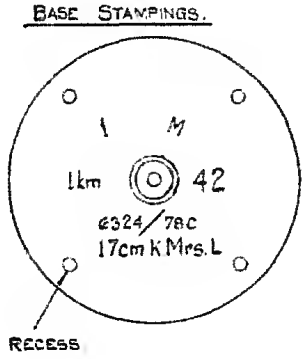
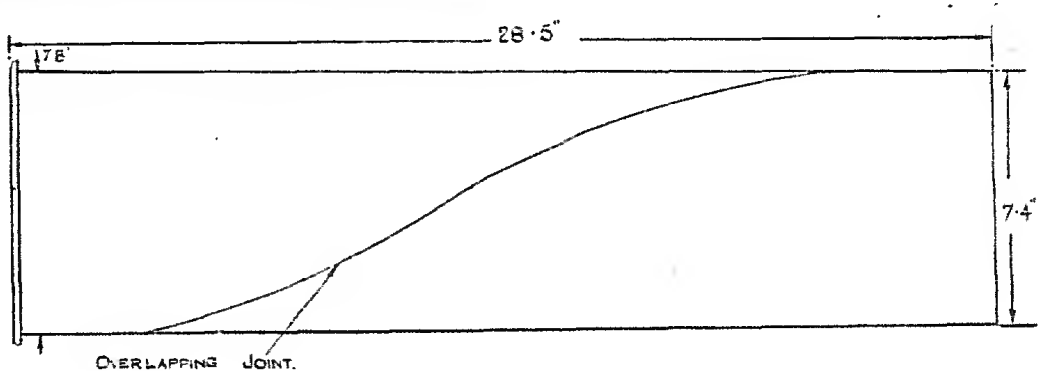

17cm. K. Mrs. Laf.
COMBINATION OF PROPELLANT CHARGES.
CORK DISC
PROPELLANT CYLINDER
VORKART. 4 INSIDE VORKART. 3
VORKART. 3.
CHARGE 3.
CHARGE 4
CARTRIDGE CASE.
CHARGE 1.
SONDERKART. 1.
IGNITER
CHARGE 2.
SONDERKART. 2 WRAPPED AROUND SONDERKART. 1.
PROPELLANT CYLINDER.
HAUPTKART.
IGNITER
IGNITER.
COILED STEEL TYPE

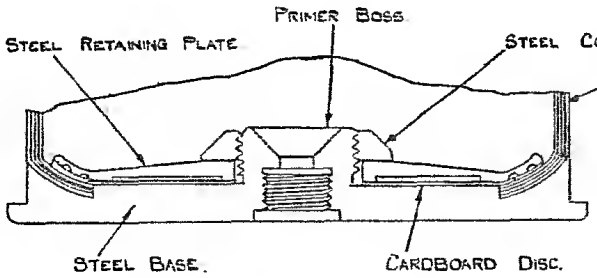
Fig. 16
31

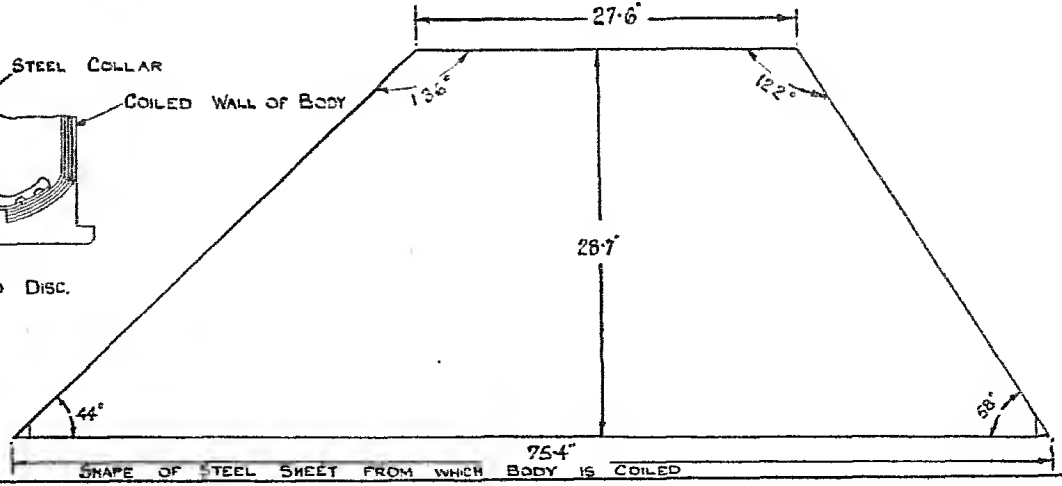
FIG. 17.
32.

GERMAN 17 cm. K. Mrs. Laf. Q.F. CARTRIDGE CASE MODEL 6324/78 C (COILED STEEL).









Section	Weight Kilograms	Nature, shape and size	Weight lb. oz. dr.	Size in Inches		
				Length	External Dia.	Internal Dia.
1 (Sonderkart 1)	14·980 Kg.	Digl.R.P.–G2–(980–7/4,2)	33 0 5	38·6	0·276	0·165
2 (Sonderkart 2)	4·890 Kg.	Digl.R.P.–G2–(980–7/4,2)	10 12 8	38·6	0·276	0·165
3 (Haupkart)	16 Kg.	Digl.R.P.–G2,5–(660–7,6/3)	35 4 8	26	0·299	0·118
4 (Vorkart 3)	12·950 Kg.	Digl.R.P.–G2,5–(660–7,6/3)	28 8 14	26	0·299	0·118
5 (Vorkart 4)	1·350 Kg.	Digl.R.P.G2,5–(660–7, 6/3)	2 15 10	26	0·299	0·118

The weights of the propellant charges, as stencilled on the bags, vary considerably and are apparently adjusted charge weights based on the performance of the propellant lot at proof.

Construction of Charge Sections

Section 1 (Sonderkart 1) is approximately 40 inches in length and consists of a bundle of tubular cords of propellant contained in a white cylindrical bag. The bag is choked at the front end and carries an igniter at the base. The igniter contains approximately 100 grams of Nz. Man. N.P.(1,5–1,5). This is the nitrocellulose powder, in the form of cylindrical grains, normally used in German igniters.

Section 2 (Sonderkart 2) is approximately 40 inches in length and consists of five comparatively small bundles of tubular cord propellant contained in separate pockets formed in a white rectangular bag. The bag is sewn from top to bottom with parallel rows of stitching to form the five pockets, the central pocket being the widest. In appearance the filled bag is similar to a cricketers leg pad and when required for use is assembled around one side of Sonderkart 1 in a similar manner and inserted in the case. This section has no igniter.

Section 3 (Haupkart) is approximately 26 inches in length and consists of a bundle of tubular cord propellant assembled around a central propellant cylinder and contained in a white cylindrical bag. The central cylinder of propellant extends through the length of the bundle and has an external diameter of 1·4 inches. The internal diameter is 1·2 inches. An igniter containing 80 grams of Nz.N.P. (1,5–1,5) is stitched to the base of the bag.

Section 4 (Vorkart 3) is approximately 27·2 inches in length and consists of a bundle of tubular cord propellant assembled around a central propellant cylinder and contained in a white cylindrical bag. The central cylinder of propellant extends through the length of the bundle and has a large cork disc, in the form of a washer,

placed over its front end which protrudes from the bundle. The external and internal diameters of the cylinder, which accommodates Section 5 (Vorkart 4) when the latter is used, are 2·75 inches and 2·5 inches respectively. The bag has an igniter containing approximately 40 grains of Nz. Man.N.P.(1,5–1,5). The forward part is marked " VORN " to indicate that the section should be loaded with this end to the front.

Section 5 (Vorkart 4) is approximately 26 inches in length and consists of a small bundle of tubular cord propellant contained in a white cylindrical bag of comparatively small diameter. The choke at the forward end of the bag is marked " 4 ". There is no igniter. This section is inserted into the propellant cylinder in Vorkart 3 when used.

The bag of each section is stencilled in black to indicate the designation of the section and the equipment, the weight, nature and size of the propellant charge, the place and year of manufacture of the propellant and the place, lot, month and year of filling. Sections suitable for use in hot climates are marked in red " AUCH FUR TROPEN " or " FUR TROPEN P.T.+ 25°C.".

Cases

Three types of case are known to be used. These are 28·5 inches in length and taper from 7·8 in front of the flange to 7·4 inches at the mouth. The first is a solid drawn brass case with the model number 6324 stamped in the base. The second type is a steel case of similar construction to the first. This case may be coated with brass or be rustproofed and has the letter " St " after the model number.

The third type is a built-up case of steel and is of unusual design. The case consists of a coiled body which is attached to the base by a retaining plate and screwed collar assembled on the primer boss. The body is formed from a four-sided sheet of steel which is shaped and coiled so that there are three and a quarter turns at the base end and only about one and a quarter at the mouth. This is apparently intended to give the case greater strength at the base. One edge of the coiled sheet forms an inclined overlapping joint extending along the length and partially round the body. A layer of black wax is used between the overlapping coils presumably to assist in waterproofing. At the base end the coiled wall is turned inwards to form a curved internal flange corresponding to the upper side of the steel base. The body is made from low carbon rimming steel and has a V.D. hardness figure increasing, rather irregularly, from 105 near the base to 133 at the mouth.

The steel base has the usual external flange or rim and primer hole. The primer boss is screwthreaded externally to receive the screwed steel collar which bears on the steel retaining plate fittings around the boss and overlapping the internal flange on the body. The retaining plate is circular with a central hole to fit over the primer boss and has two circular grooves near its circumference where it is

curved upwards to correspond with the flange on the body. A cardboard disc with its surface covered with black wax is inserted beneath the retaining plate to seal the joint. The stamping in the base of the case includes the model number " 6324/78C " and the designation " 17 cm. K.Mrs. L.". Four equally spaced circular recesses are formed in the base for the purpose of assembly.

Packing

The case and charge sections are packed as follows :—

Charge Section, etc.	Quantity	Package	Weight
Sonderkart 1 and 2 ..	1 of each	Cylinder	61 lb.
Haupkart in case ..	1	Cylinder	84 lb.
Vorkart 3	1	Cylinder	43 lb.
Vorkart 4	24	Box	134 lb.

GERMAN 20 cm. LIGHT SPIGOT MORTAR H.E. ROUND. (20 cm. Wgr.40)

(Figs. 18 and 19)

The 20 cm. H.E. bomb, Model 40, is fired from the 20 cm. Leichter Ladungswerfer (a spigot mortar with a 9 cm. spigot) with a separately loaded cartridge.

The streamlined bomb has an ogival head with a Wgr.Z.36 fuze, or a plug with a lifting loop, at the nose and has a tail tube carrying six vanes. The exterior is painted the normal deep olive green and stencilled in black. The stencilling includes the H.E. numeral " 13 " near the nose (indicating amatol) and the weight class on the cylindrical part of the body. A fuzed bomb bearing the weight class marking " N " weighed 48·75 lb. The overall length, including the fuze, was 31·15 inches and the maximum diameter, approximately 20 cm. The bomb is supplied plugged and fitted with a cylindrical cover of cardboard and steel for the protection of the tail vanes.

The cartridge is short and cylindrical, the lower part being of steel with a partially flanged adapter for the C/23 electric primer at the base and a bakelite upper part. The approximate dimensions are : length 2·2 inches, diameter 3·5 inches. A label giving details of the igniter and propellant charges is affixed to the top of the cartridge.

Bomb

The bomb body is of pearlitic malleable cast iron with a screw-threaded fuze hole at the nose and a tubular extension formed at

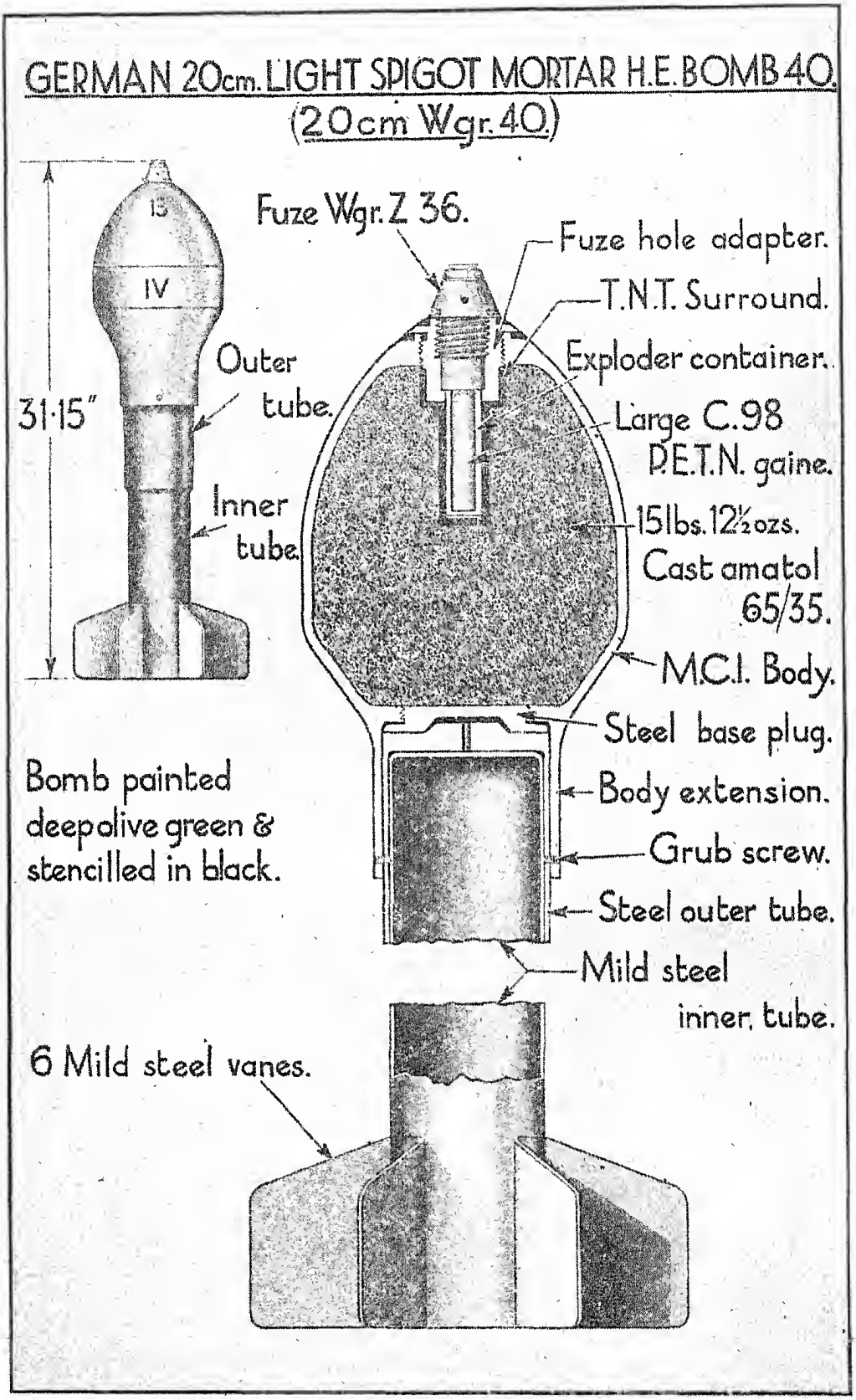

GERMAN 20cm. LIGHT SPIGOT MORTAR H.E. BOMB 40.
(20cm Wgr. 40.)
15
IV
31·15"
Outer tube.
Inner tube.
Fuze Wgr. Z 36.
Fuze hole adapter.
T.N.T. Surround.
Exploder container.
Large C.98
P.E.T.N. gaine.
15lbs. 12½ozs.
Cast amatol 65/35.
M.C.I. Body.
Steel base plug.
Body extension.
Grub screw.
Steel outer tube.
Mild steel inner tube.
Bomb painted deep olive green & stencilled in black.
6 Mild steel vanes.

Fig. 18

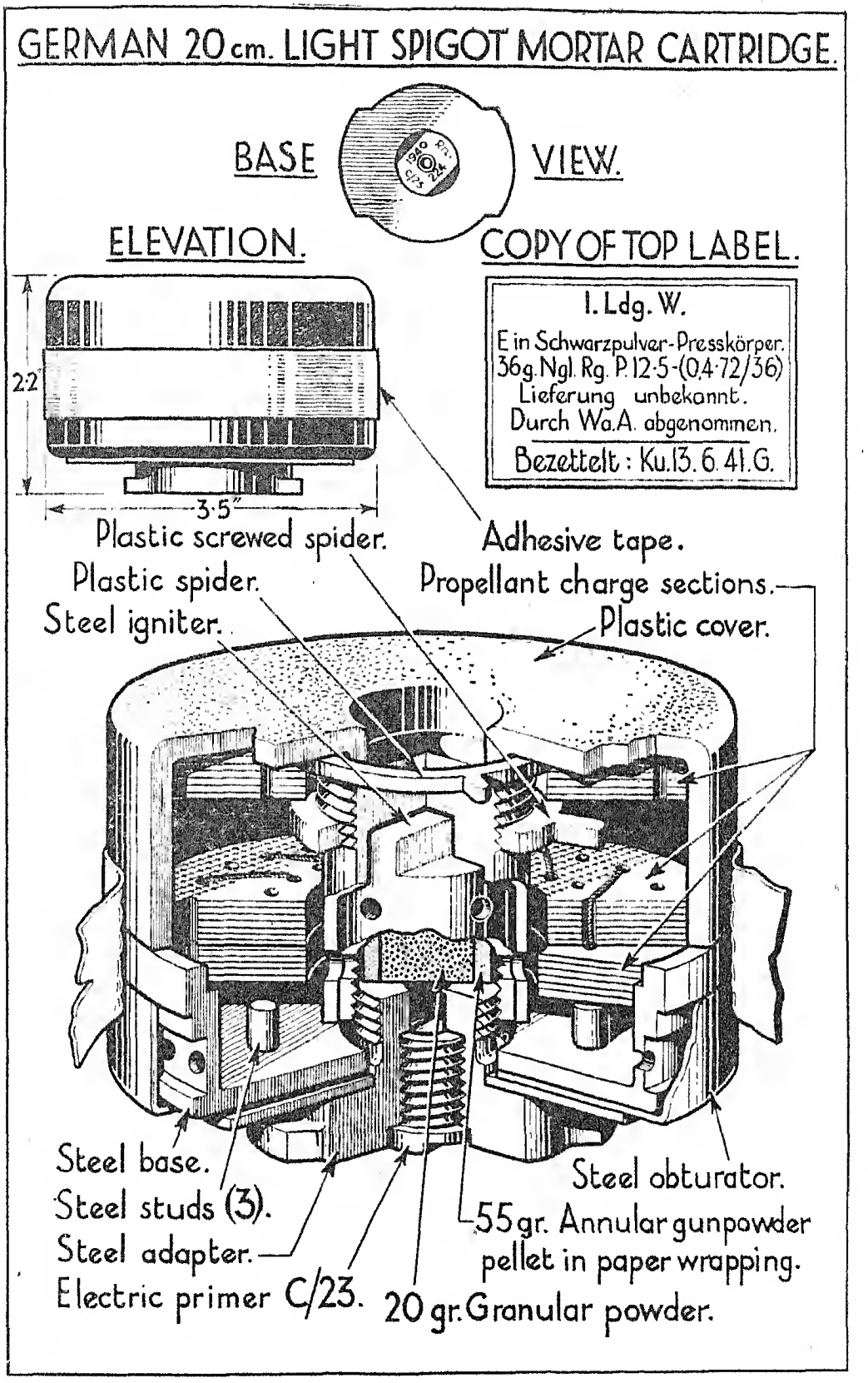

GERMAN 20 cm. LIGHT SPIGOT MORTAR CARTRIDGE.
BASE
VIEW.
ELEVATION.
COPY OF TOP LABEL.
I. Ldg. W.
E in Schwarzpulver-Presskörper.
36g. Ngl. Rg. P. 12·5-(0,4·72/36)
Lieferung unbekannt.
Durch Wa.A. abgenommen.
Bezettelt: Ku. 13. 6. 41. G.
2·2"
3·5"
Plastic screwed spider.
Adhesive tape.
Plastic spider.
Propellant charge sections.
Steel igniter.
Plastic cover.
Steel base.
Steel studs (3).
Steel adapter.
Electric primer C/23.
Steel obturator.
55 gr. Annular gunpowder pellet in paper wrapping.
20 gr. Granular powder.

Fig. 19

the base for the attachment of the tail unit. A large hole in the base of the body, within the tubular extension, is closed by a steel screwed plug. A steel fuze hole adapter, inserted at the nose, carries an exploder container of mild steel.

The tail unit consists of a short outer tube and an inner tube which carries the vanes. The outer tube is of chromium-silicon steel with a V.D. hardness figure of 262 and is closed at the front end where the thickness is increased to correspond to a recess in the base plug. A small central hole in the closed end is formed probably for the escape of air during assembly. The inner tube is of mild steel and is also closed at the front end. The two tubes are retained in the tubular extension of the body by two grub screws inserted at diametrically opposite positions in the extension. The rear part of the inner tube protrudes from the inner tube and has six vanes welded to it in pairs.

The weight of the empty bomb is 30·97 lb., the body alone weighing 16·65-lb.

Method of Filling

The bursting charge consists 15-lb. 12½-oz. of cast amatol 65/35 with a thin surround of T.N.T. to the exploder cavity. The exploder container carries the larger size of the C/98 P.E.T.N. gaine.

Fuze and Gaine

The Wgr. Z.36 fuze is described in this pamphlet as a separate item.

The gaine " Gr.Zdlg.C/98 Np " is described in Pamphlet No. 6.

Cartridge

The cartridge is in the form of a short cylindrical box consisting of a steel cup-shaped body with a cover of moulded plastic. The propellant charge, in three sections, is contained inside with a steel igniter containing gunpowder.

The steel body has a hole in the base for the assembly of an adapter which carries the primer and around its exterior has a groove which is connected to the interior by a ring of radial holes and is covered by a steel obturating cup fitted over the base. The cup is expanded by the pressure of propellant gases through the holes. Inside the body there are three equally spaced steel studs protruding from the base for the support of the lowest section of the propellant charge. The obturating cup is supported at the base by a steel disc and the adapter. The steel adapter has an interrupted flange to enable the cartridge to be inserted in the top of the spigot and to be locked to the spigot by turning. A screwthreaded primer hole is formed in its base and at the front end it is screw-threaded externally to receive the steel igniter which secures it to the body.

The steel body of the igniter is in the form of a perforated cylinder

which is closed at the top where it is shaped to form two flat surfaces for the tool used in screwing it to the front end of the adapter.

The plastic cover is an inverted cup with a cylindrical centre piece formed inside which is shaped to fit over and surround the igniter and has corresponding perforations. The centre piece is screwthreaded near the top to receive a screwed plastic spider which supports one of the charge sections. A second spider without a screwthread is used as a distance piece between the top of the charge section and the cover. The top of the cover is recessed and carries a white paper label giving the particulars of the propellant.

Both body and cover are stepped so that the cover fits into the body and the junction is sealed with a wrapping of adhesive tape.

Method of Filling

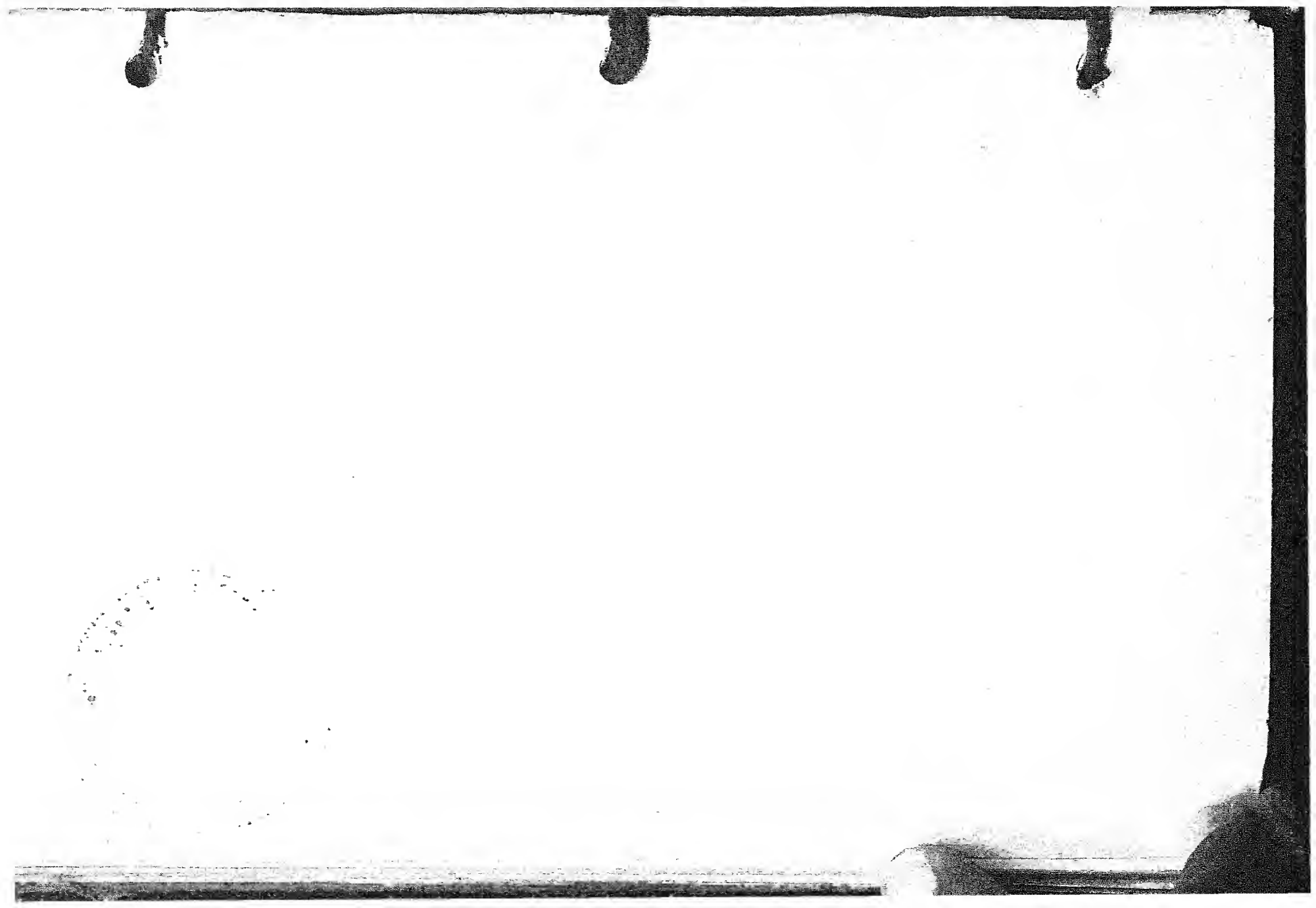
The igniter contains a 55 grain, paper wrapped, annular pellet of gunpowder inside of which there is a 20 grain filling of small grain gunpowder.

The 36 gram propellant charge of "Ngl.Rg.P.–12·5–(0),4·72/36)," a double base nitroglycerine propellant in ring form, is divided into three sections of equal weight. Each section in the cartridge examined weighed 186 grains and consisted of a number of annular discs perforated with two rings of holes and roughened by an impressed pattern on both sides. The discs are secured by silk ties threaded through the perforations in three places. Each of the discs is between 0·014 and 0·018 inch thick and has a diameter of 2·8 inches. The diameter of the central hole is 1·4 inches. One section of the charge, with another placed on top of it, is supported on the three studs inside the steel body. The third section is carried inside the plastic cover where it is separated from the cover by a spider of plastic and supported by a similar spider screwed to the centre piece.

Primer

The electric primer C/23 is described in this pamphlet.

(3379.) 68526. Wt. 14746-2343. 10M. 7/44. A., P. & S., Ltd. 428.



HANDBOOK
OF
ENEMY AMMUNITION

PAMPHLET No. 14

GERMAN ROCKET, GUN AND MORTAR AMMUNITION

By Command of the Army Council,

L. Parsons.

THE WAR OFFICE,
10*th February*, 1945.

21780

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HANDBOOK
OF
ENEMY AMMUNITION

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German Ammunition

HANDBOOK
OF
ENEMY AMMUNITION

GERMAN FUZE A. Z. 1.

Fig. 1

This fuze is of the direct action and graze type with an optional delay of 0·15 seconds. It is used with low velocity equipments as a substitute for the AZ 23 (0·15). The design is similar in principle to the latter fuze, but the springs surrounding the centrifugal safety segments and operating the delay shutter are weaker. The fuze may be identified by the stamping " AZ 1 " on the flange as illustrated in Fig. 1.

The fuze consists of the following principle components, steel body, light alloy ballistic cap, wooden needle extension, steel needle, creep spring, six light alloy centrifugal segments, a copper covered expanding spring, detent and spring, steel inertia pellet with detonator, plastic holder, delay mechanism, and securing ring.

All steel components are rust proofed.

The body is screwthreaded below the flange for insertion in the shell and is provided with a domed top which is secured by pressing the top of the flange around the side of the dome. The top of the dome is bored centrally in two diameters and bushed to receive the sleeve and needle holder.

The ballistic cap is attached to the fuze body by canneluring it above the flange and turning its lower edge under the flange. The top of the cap is flat and closed by spinning it over a small disc of the same material.

The wooden rod, 2·3 inches long, forms an extension to the needle under the ballistic cap. Its head is housed in the top of the cap and its lower end is accommodated in a steel sleeve above the needle.

The sleeve protrudes from the top of the dome and its forward movement is limited by a flange which bears against a shoulder in the top of the dome.

The needle is secured in a steel holder which is recessed on its underside to form a seating for one end of the creep spring. The other end of the spring is seated on a shoulder in the inertia pellet. On the underside of the holder are six centrifugal segments each pivoted on a pivot pin.

The segments are kept towards the centre of the fuze by the expanding spring and are so arranged that one, which locks the remainder, is itself locked by a detent with spring which protrudes from the top of the mechanism holder.

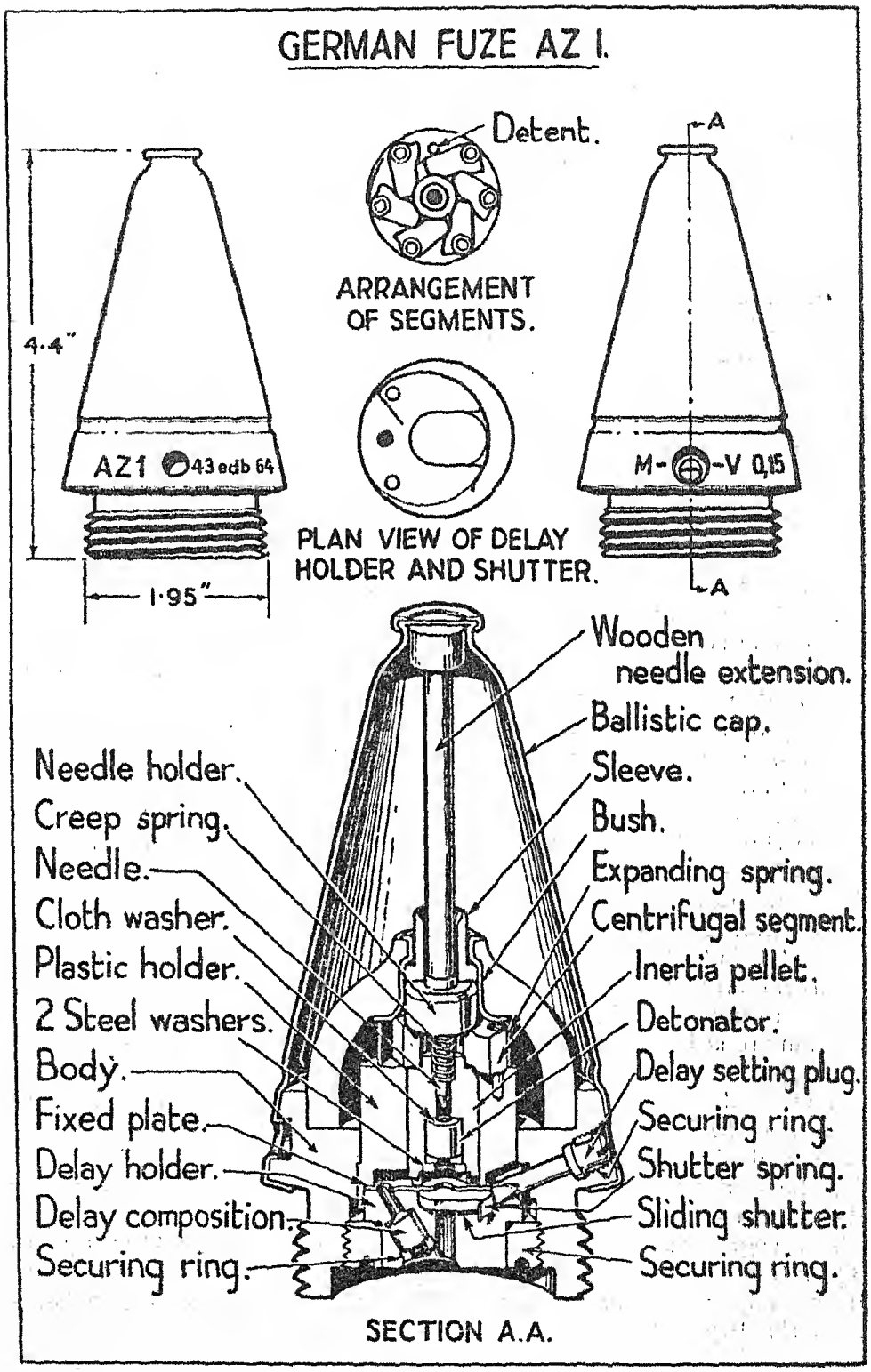

GERMAN FUZE AZ I.
Detent.
ARRANGEMENT OF SEGMENTS.
4·4"
AZ1 43 edb 64
1·95"
PLAN VIEW OF DELAY HOLDER AND SHUTTER.
A
M- -V 0,15
A
Wooden needle extension.
Ballistic cap.
Sleeve.
Bush.
Expanding spring.
Centrifugal segment.
Inertia pellet.
Detonator.
Delay setting plug.
Securing ring.
Shutter spring.
Sliding shutter.
Securing ring.
Needle holder.
Creep spring.
Needle.
Cloth washer.
Plastic holder.
2 Steel washers.
Body.
Fixed plate.
Delay holder.
Delay composition.
Securing ring.
SECTION A.A.

FIG. 1

The mechanism holder is cylindrical and in two diameters; it is bored centrally to accommodate the inertia pellet. The top of the holder forms a platform for the centrifugal segments; its underside is recessed to accommodate the delay shutter and to provide a flash channel to the delay filling.

The inertia pellet is bored in three diameters to accommodate at the top the needle and creep spring and, at the bottom the detonator which is secured between a paper disc and a cloth or millboard washer at the top, and two steel washers at the bottom.

The delay mechanism consists of a delay holder, sliding shutter, spring, delay setting plug, thin fixed plate and a screwed securing ring. All these pieces excepting the spring are made from light alloy.

The delay holder is provided with two channels, one bored centrally and empty, and the other bored at an angle so that the top is displaced from the centre and the bottom is in communication with the bottom of the central channel. The inclined channel is filled with a pellet of delay composition secured by a screwed ring. A recess in the top surface of the holder accommodates a centrifugal shutter which, at rest, masks the central channel; it is retained in this position by a light spring. In flight, movement of the plate is regulated according to the position of the delay setting plug. The setting plug is accommodated in an inclined radial channel in the fuze body and is secured by a screwed ring. The outer end of the plug is slotted for setting purposes and also to serve as an index, and its inner end is chamfered to a screwdriver edge. When set for delay action, it retains the shutter in the closed position, when set to non-delay, the chamfered end of the setting plug permits the shutter to slide outwards, under centrifugal action, to unmask the central channel. A fixed thin plate, with two holes corresponding with the delay and central fire channels, is fitted on the holder and forms an upper bearing surface for the shutter. The holder closes the bottom of the fuze and is retained by a screwed alloy ring.

Action

Before firing.—The needle is separated from the detonator by the centrifugal segments which are retained in the closed position by their spring. The shutter of the delay mechanism closes the central fire channel by the pressure of its spring.

To set the fuze for non-delay action, the slot in the index plug is turned to a position parallel to the axis of the fuze thereby permitting the shutter to slide out under centrifugal action when in flight. For delay action the plug is turned until the slot is positioned at right angles to the fuze axis and in alignment with the stampings "M" and "V 0,5" on the ballistic cap; in this position the plug retains the shutter in the closed position.

On firing.—The detent locking the centrifugal segments sets back, the spring surrounding the segments expands, and the segments

swing outwards one after the other under centrifugal action thus allowing the needle and inertia pellet free movement towards each other. The creep spring, however, prevents creep action. If the fuze is set for delay action, the setting plug retains the shutter which masks the central flash channel. If the fuze is set for non-delay action, the position of the setting plug permits the shutter to slide outwards and unmask the central flash channel.

On impact.—The needle is forced on to the detonator by direct action. On graze the inertia pellet carries the detonator on to the needle. The flash from the detonator passes either through the central flash channel or the delay channel according to the setting of the fuze.

GERMAN FUZE Wgr Z. T.
(Fig. 2)

This is a direct action and graze fuze with a plastic body and is used in 5 cm., 8 cm., and 10 cm. H.E. Mortar bombs. The fuze may be identified by the stamping " Wgr Z T " above the flange. An exterior view of the fuze showing stampings is illustrated in Fig. 2.

The principal parts are the body, needle, needle spring, inertia pellet with detonator, a large segment housing a detent arming arrangement, a small segment with an irregular groove, and a base closing plug.

The plastic body is reinforced at its forward end by embedding in it, a thin perforated sheet of metal shaped to a cone and joined by a metal clip. The body is bored centrally in three diameters. At the top two chambers, separated by a diaphragm accommodates the needle, needle holder and spiral spring and, below these chambers, another accommodates the fuze mechanism. The top of the fuze is closed by a laminated plastic disc.

The head of the needle is embedded in a plastic holder which has an annular recess on its underside to form a seating for one end of the needle spring. The stem of the needle passes through the diaphragm which also provides a seating for the other end of the spring.

The inertia pellet consists of a white metal detonator holder, upper and lower plastic bushes, creep spring, detonator and plastic washer. The detonator holder is cylindrical, has an internal flange at one end, and is bored centrally in two diameters to form chambers which accommodate the bushes, spring and detonator. The upper bush has an external flange and is inserted in the holder from the bottom so that its smaller diameter protrudes and forms a guide for the point of the needle. It is retained in this position by the spiral creep spring. One end of the spring is seated against the shoulder of the upper bush whilst the other is seated on the shoulder

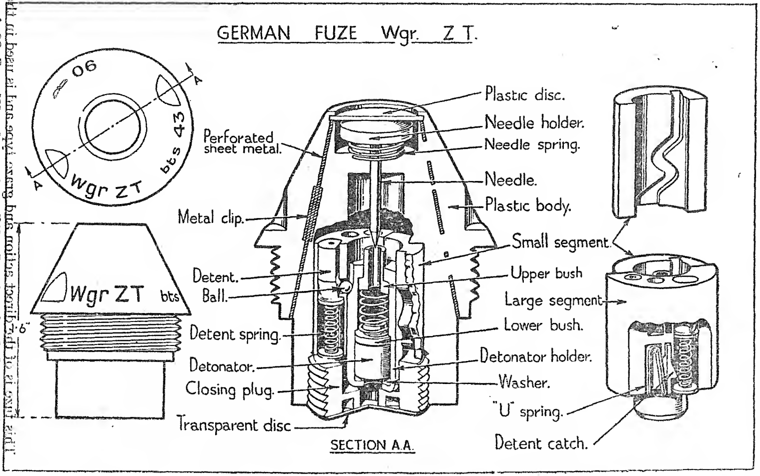


Fig. 2

This fuze is of the direct action and graze type and is used in the 8 cm. Mortar H.E. bomb. It differs from the Wgr. Z 38 fuze

of the lower bush. The lower bush, assembled from the bottom, bears against an internal shoulder in the detonator holder. The detonator is held between the lower bush and a plastic washer which is secured by turning the base of the holder over the washer. A stud on the outside of the pellet engages a groove in the smaller of the two plastic segments surrounding the pellet. Diametrically opposite the stud, the forward end of the pellet is cut away to partly accommodate a ball which locks the pellet in the unarmed position.

The large segment accommodates the arming arrangement which consists of a metal detent, spiral spring, plastic seating disc, steel ball, U shaped spring and a detent catch.

The detent is cylindrical, partly tapered towards a flanged base and has a flat on one side. It is accommodated in the top of a long chamber and its forward movement is limited by the flange which bears against a shoulder in the chamber. The flat retains a ball in a radial hole, thus locking the inertia pellet in the safe position. The detent is retained in this position by the spring which has a seating disc at its base end. A shorter chamber accommodates the inverted U shaped spring and detent catch. The catch is held between the spring and two longitudinal projections formed in the segment.

The base of the fuze is closed by a screwed plug with a transparent disc closing the flash hole.

Action

Before firing.—The inertia pellet containing the detonator is locked and held away from the needle by the steel ball.

On firing.—The detent sets back, and its flange is engaged and held by the detent catch under the action of its spring, thereby freeing the ball and releasing the inertia pellet.

During deceleration, the inertia pellet creeps forward but, through its stud, its movement is controlled by the irregular groove in the small segment. The pellet creeps forward until the upper bush bears against the diaphragm surrounding the needle. Further creep is then prevented by the creep spring.

On impact the needle holder compresses the needle spring and forces the needle on to the detonator.

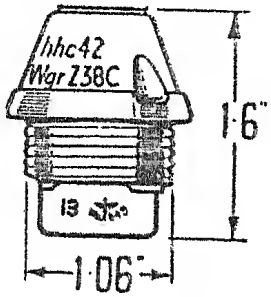
On graze the creep spring is compressed and the detonator is carried forward by its holder on to the needle. The flash from the detonator passes through the flash hole in the closing plug to the gaine in the shell.

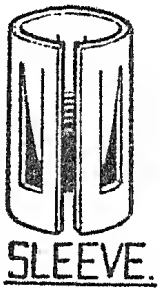
GERMAN FUZE Wgr. Z. 38c

(Fig. 3)

This fuze is of the direct action and graze type and is used in the 8 cm. Mortar H.E. bomb. It differs from the Wgr. Z 38 fuze

GERMAN FUZE Wgr Z 38C.





SLEEVE.

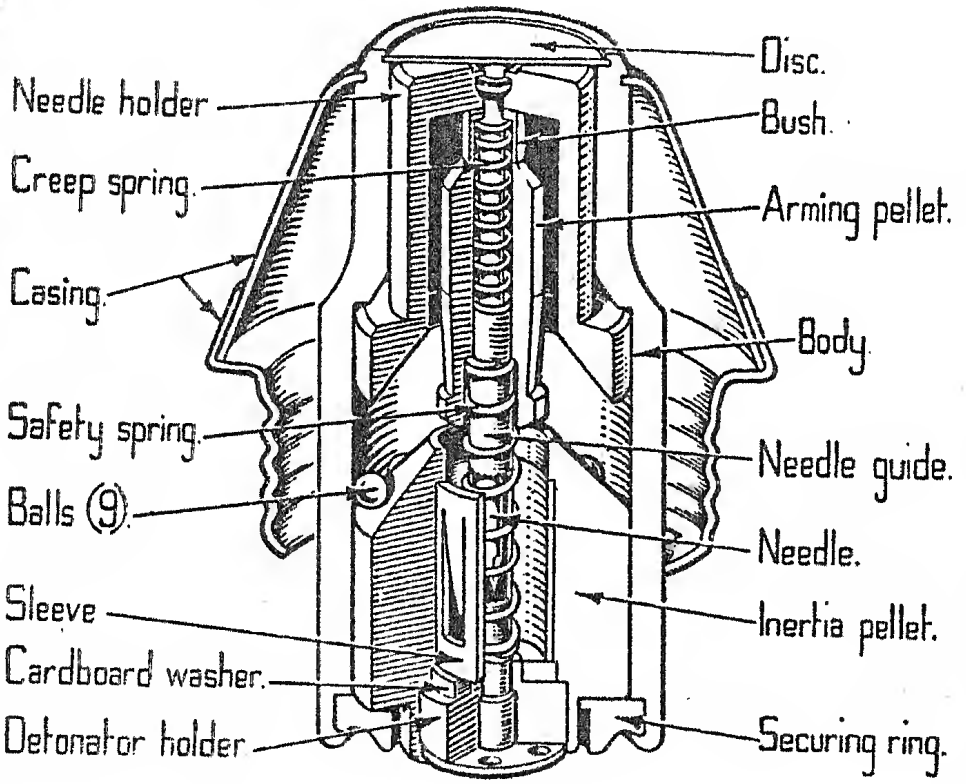


FIG. 3

described in Pamphlet No. 4, principally in that it is not fitted with a gaine and that the fuze body at the nose end is reduced in external diameter and enclosed in a steel casing.

The fuze consists mainly of a steel body, nine steel balls, needle, needle holder, creep spring, arming pellet, safety spring and inertia pellet.

The body is bored in two diameters to form a chamber at the head to accommodate the needle holder and another at the base to house the inertia pellet and nine steel balls. The top of the fuze body is closed by a brass disc which is secured by turning the end of the body over it. Attached to the body is a steel casing, in two parts, which surrounds the head and forms a flange to the fuze. The lower part of the case has a pressed screwthread below the flange for insertion in the bomb and the upper part is shaped to suit the external contour of the bomb. The space between the fuze body and casing is empty.

The head of the steel needle is secured in a cup shaped light metal holder, and its point is housed in a tubular guide attached to the inertia pellet. The needle holder is chamfered internally and flanged externally at the lower end.

The creep spring, and the light metal arming pellet with a cup-shaped bush at the top, surrounds the stem of the needle. One end of the creep spring is seated in the bush whilst the other is seated on the upper end of the needle guide.

The arming pellet is bored in two diameters and provided with an external flange at its base. The smaller boring accommodates the upper end of the needle guide, and the shoulder formed by the larger boring forms a seating for one end of the safety spring.

The inertia pellet consists mainly of a body, detonator holder, detonator, needle guide and brass sleeve.

The steel body is cylindrical and, externally, is chamfered at its forward end and provided with a shoulder at its base. It is bored centrally in several diameters to house the detonator holder and the fuze mechanism. The body is secured in the fuze by a steel ring.

The detonator holder has a shoulder at its forward end, and is bored centrally in two diameters to accommodate the detonator in the lower chamber and, above it, the end of the light metal tubular needle guide. The detonator and holder are secured in the pellet by turning its base over a perforated steel disc. A cardboard washer is fitted to the forward end of the holder.

The brass sleeve is split, and three tongues, cut in its side, are bent inwards to form springs.

The nine steel balls are located between the needle holder and the inertia pellet.

Action

Before firing.—The needle is prevented from coming in contact with the detonator by the nine steel balls.

After firing.—On acceleration the arming pellet, needle holder and needle set back compressing the safety spring. The arming pellet is then held by the springs in the sleeve engaging its flange. The needle is prevented from piercing the detonator by the steel balls. During flight, on deceleration, the needle and its holder are returned to their former position by the action of the creep spring, and the balls creep forward into the recess in the needle holder vacated by the arming pellet.

On impact, the creep spring is compressed and the needle fires the detonator. On graze, the inertia pellet carries the detonator on to the needle.

GERMAN FUZE Wgr. Z 50 + (Type A) for ROCKET PROJECTILES

(Fig. 4)

Three types of Fuze Wgr. Z 50 + have been met with, each is similar in principle but differs in detail. For convenience in reference they are referred to as types A, B and C. The fuze described in Pamphlet No. 13 is type B.

A plastic adapter is provided to enable the fuzes to be fitted in the standard 5 cm. (1·96 inches) fuze hole, and a plastic container is also provided for packing in transport.

Type A

This fuze differs from type B, externally in its contour at about the flange and, internally in the shape of the needle holder, detonator holder and the centrifugal bolts with spring. The remaining components are similar to type B.

The base end of the needle holder is lengthened and recessed on its underside to form a sleeve accommodating the forward end of the detonator holder. The sleeve portion is provided with two radial holes through which pass the inner ends of two centrifugal bolts.

The detonator holder is reduced in diameter at the forward end and provided with a circumferential groove to receive the inner ends of the centrifugal bolts when in the unarmed position.

The centrifugal safety mechanism consists of two bolts each with a spiral spring and securing plug. The bolts are accommodated in radial borings diametrically opposed in the fuze body so that in the unarmed position the bolts pass through the sleeve portion of the needle holder to engage the circumferential groove in the detonator holder. They are retained in this position by a brass spiral spring seated between the outer ends of the bolts and a screwed closing plug. The bolts and the plugs are recessed to form a seating for the spring.

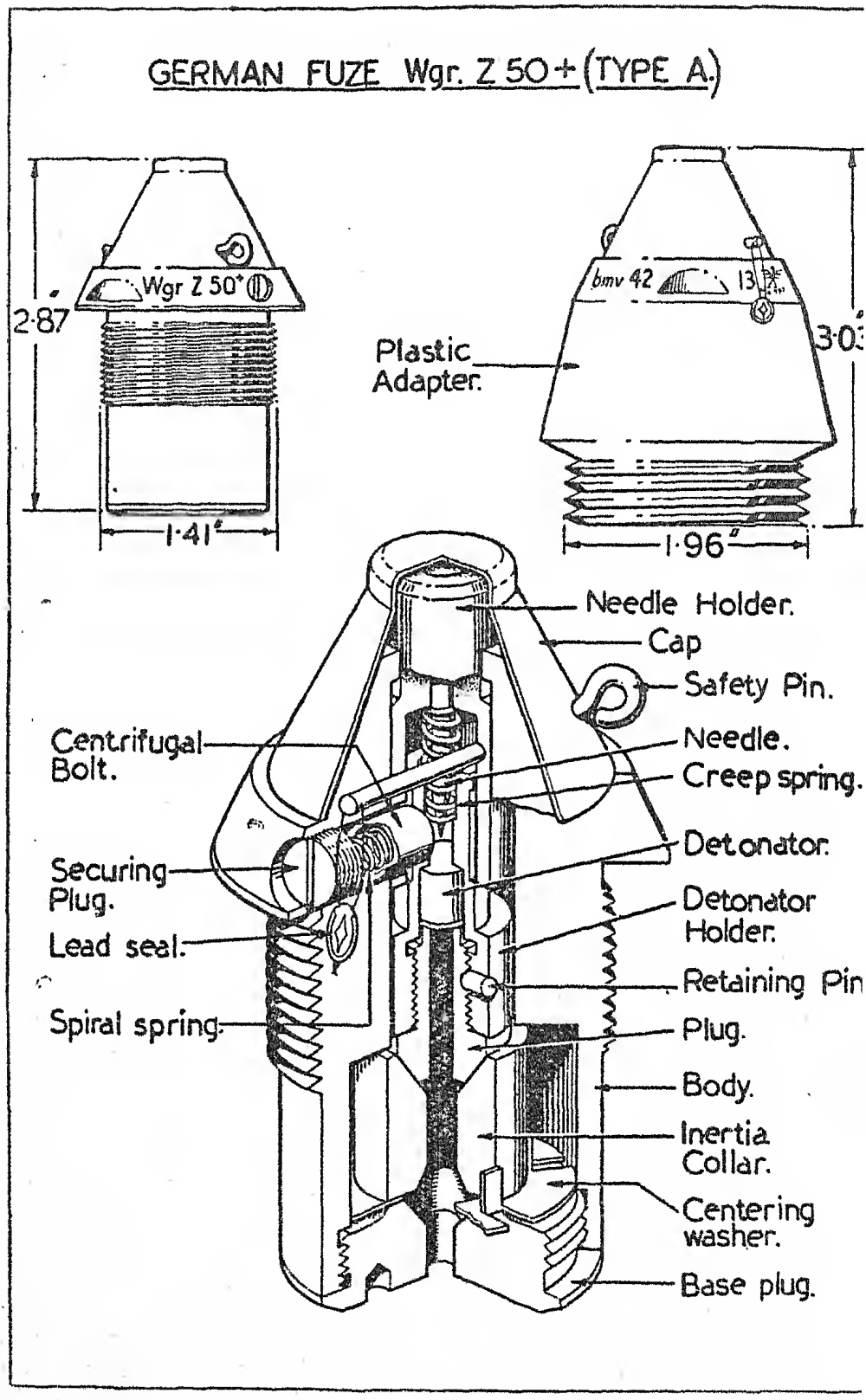

GERMAN FUZE Wgr. Z 50+ (TYPE A.)
Wgr Z 50°
2·87
1·41"
bmv 42
13
3·03
Plastic Adapter.
1·96"
Needle Holder.
Cap
Safety Pin.
Needle.
Creep spring.
Detonator.
Detonator Holder.
Retaining Pin
Plug.
Body.
Inertia Collar.
Centering washer.
Base plug.
Centrifugal Bolt.
Securing Plug.
Lead seal.
Spiral spring.

FIG. 4

Action

Before firing.—The safety pin is withdrawn and the cap removed. The needle is separated from the detonator by the centrifugal bolts which lock the needle holder and detonator holder together.

After firing.—During acceleration the needle holder sets back and prevents the outward movement of the centrifugal bolts until the projectile is well clear of the projector. When the centrifugal force is sufficient to overcome the friction between the needle holder and the bolts and the resistance of the springs, the bolts move outwards thus allowing the needle holder and detonator holder free movement. The needle holder moves forward slightly under the action of the creep spring which also prevents creeping of the detonator holder.

On impact the needle is forced on to the detonator by direct action. On graze the detonator is carried forward on to the needle, or it may be forced on to the needle by a sideways movement of the inertia collar. The flash from the detonator passes through the central fire channel in the inertia collar and base plug to the gaine in the shell.

NOTE.—A red band around the needle holder is exposed when the fuze is in the armed position.

GERMAN NOSE FUZE Kz. C/27 (Lm)

(Fig. 5)

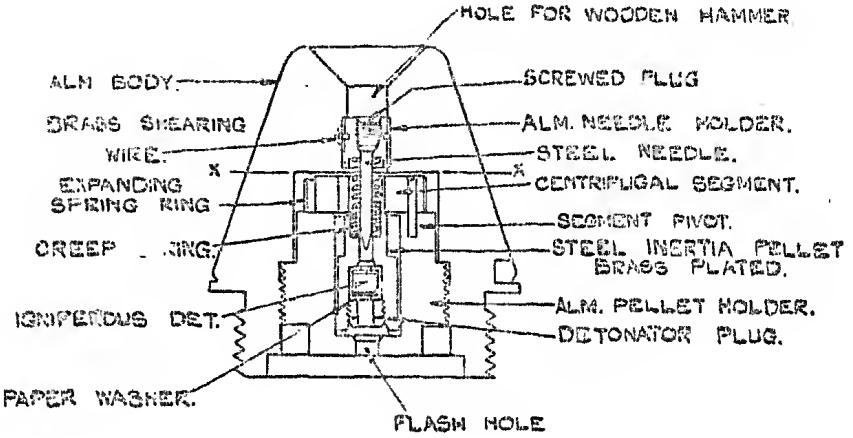
This is an igniferous nose fuze of the direct action and graze type. It is designed to function on impact through a wooden extension rod or on graze, and is used under the ballistic cap of shell of naval design, for heavy guns. The rod forms an extension to the needle. One end is accommodated in a recess in the nose of the fuze body whilst the other is located in the top of the ballistic cap.

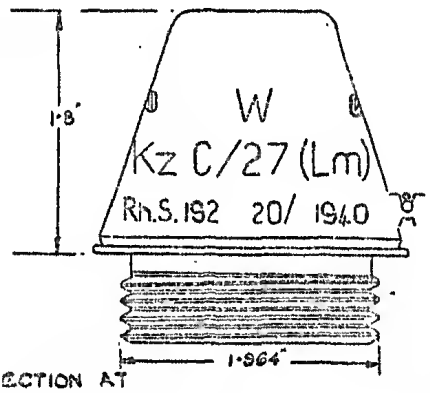
The aluminium body of the fuze is screwthreaded externally at the base for insertion into the shell and recessed internally to take an aluminium needle holder and the graze mechanism.

The needle is of steel and is secured by a steel plug which screws into the needle holder. The needle holder is supported in the body by a brass shearing wire. The stem of the needle is surrounded by a creep spring and the point is accommodated in the top of the inertia pellet.

An aluminium pellet holder with a central flash hole at the base and recessed internally to house the inertia pellet is screwed into the base of the fuze. On top of this holder are five fixed pivots on which are mounted five brass centrifugal segments surrounded by an expanding spring ring of phosphor bronze which maintains them in position overlapping the top of the inertia pellet and preventing it from forward movement.

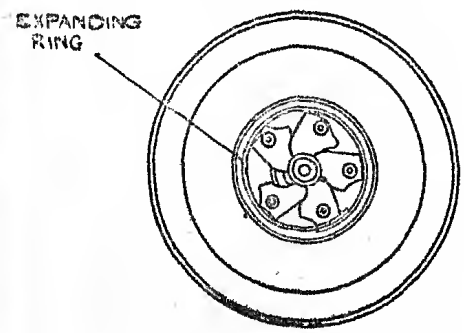
GERMAN FUZE K.Z. C/27 (Lm)





PLAN SECTION AT X-X SHOWING SEGMENTS.

SECTION THROUGH X-X SHOWING INSIDE STAMPINGS AND SCREWED PLUGS HOLDING SHEARING WIRE.



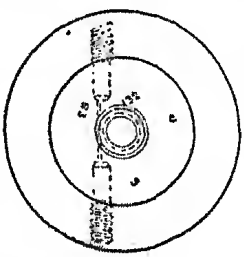


FIG. 5

The inertia pellet which is of steel, brass plated, has a central cavity housing the igniferous detonator and is closed at the base by a paper washer and a brass screwed plug with a central flash hole.

The detonator consists of a copper shell closed at each end by a copper disc ·003 inch thick and contains 2·3 grains of composition above ·86 grains of glazed gunpowder. The composition is made up of mercury fulminate 27·7 per cent., potassium chlorate 38·7 per cent., antimony sulphide 26·9 per cent., and ground glass 6·7 per cent.

Action

On acceleration the needle is prevented from setting back on to the detonator by the segments and possibly by the shear wire. Centrifugal force set up by the projectile in flight causes the spring ring to expand and permit the segments to rotate clear of the inertia pellet thus leaving the needle and inertia pellet held apart by the shear wire and creep spring. On impact the shear wire is broken ; on graze or impact the spring is compressed by the striker being driven in and the graze pellet setting forward. The flash produced by the needle piercing the detonator passes through the flash channel to the gaine of the shell.

GERMAN BASE FUZE Bdz. C/38

(Fig. 6)

This is an igniferous base fuze of the graze type with delay action and is used in shell for heavy guns, the ammunition of which is often of naval design.

The body is of steel, brass plated, and closed at the forward end by a screwed-in brass head with a central cavity and flash hole sealed with a brass disc and varnish. The body is screwthreaded externally for insertion into the shell and recessed internally to take the graze mechanism. The head is screwthreaded internally to take a brass plug which holds a screwed brass delay unit at its forward end.

The needle is of steel and is secured by a steel plug which screws into the needle holder. The point of the needle protrudes into the top of the graze pellet. The recess in the fuze body houses a steel platform which carries five centrifugal segments overlapping the top of the brass graze pellet. The segments are encircled by an expanding ring of phosphor bronze which retains them in the overlapping position and thus prevents forward movement of the graze pellet.

The brass graze pellet, which is closed at the base by a screwed-in steel plug, houses a detonator holder resting on a fibre washer. The detonator consists of a copper shell closed at the top by a copper

3a—21780

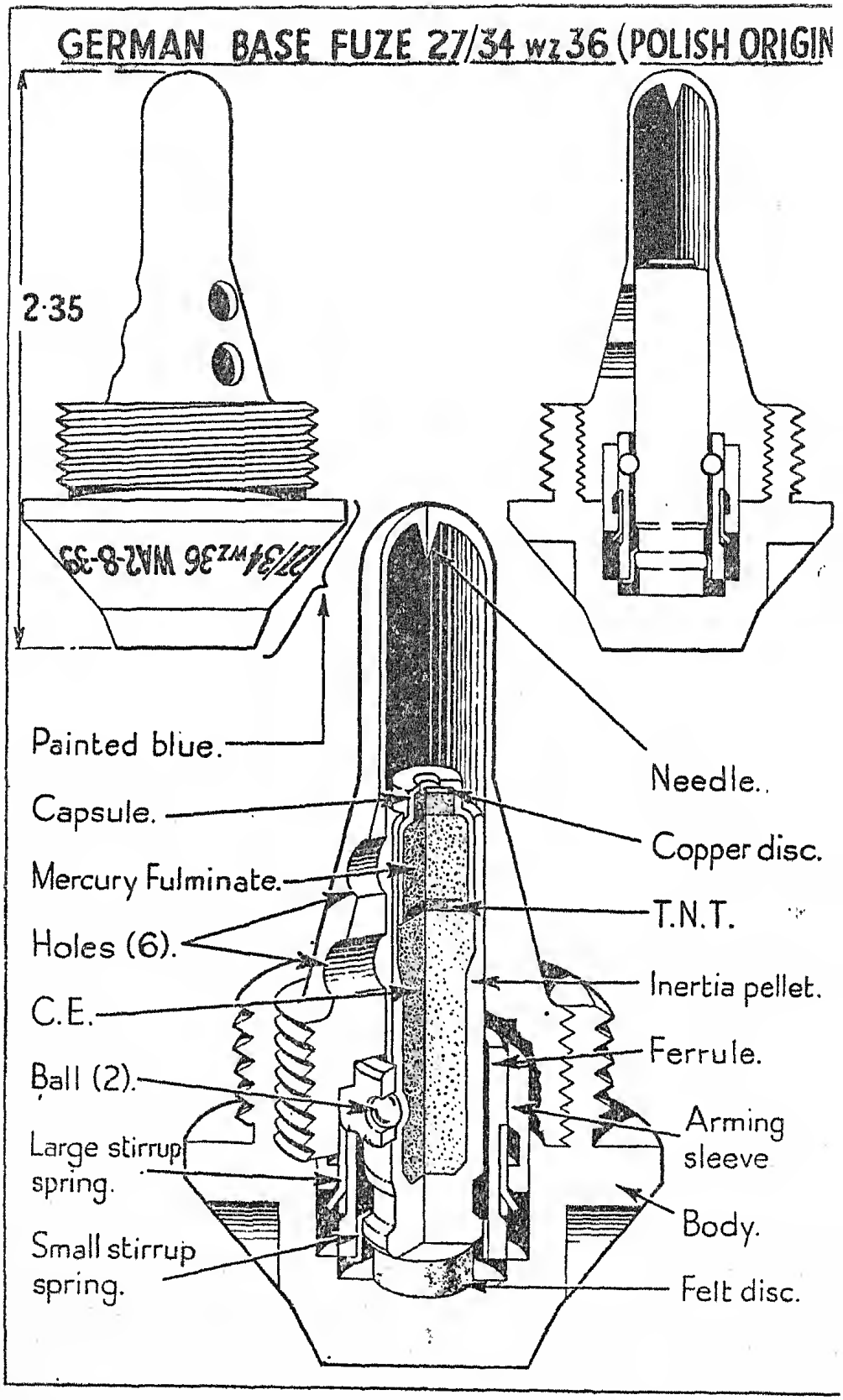

GERMAN BASE FUZE 27/34 wz 36 (POLISH ORIGIN
2·35
Painted blue.
Capsule.
Mercury Fulminate.
Holes (6).
C.E.
Ball (2).
Large stirrup spring.
Small stirrup spring.
Needle.
Copper disc.
T.N.T.
Inertia pellet.
Ferrule.
Arming sleeve
Body.
Felt disc.

FIG. 7

Above the disc is a composition, weighing 0·026 grams, and consisting of mercury fulminate 22·0 per cent. potassium chlorate 40·5 per cent. antimony sulphide 33·6 per cent. and ground glass 3·9 per cent. Above this composition is a pellet of mercury fulminate weighing 0·57 grams with a thin layer of T.N.T. weighing 0.04 grams on top. The capsule is inserted in the inertia pellet open end first, and secured by turning the end of the pellet over the base of the capsule and varnishing the join.

A felt disc is inserted between the base of the inertia pellet and the fuze body.

The ferrule is cylindrical with an external circumferential recess about its centre.

Near its forward end are two holes, bored diametrically opposite, which partly accommodate the two steel balls. The ferrule surrounds the base end of the inertia pellet and is supported by the smaller of the two stirrup springs.

The stirrup spring is cylindrical, its lower edge has three external projections which fit under the ferrule and its upper edge has three internal projections which engage in the recess near the base of the inertia pellet.

The arming sleeve is cylindrical with a circumferential internal recess near its base edge. It surrounds the forward part of the ferrule and retains the two steel balls locking the inertia pellet in the safe position. The sleeve is supported by the larger stirrup spring.

The stirrup spring is cylindrical and split. Two lugs, cut diametrically opposite in its lower edge, project and fit under the arming sleeve.

Action

Before firing.—The inertia pellet is locked and held away from the needle by the two steel balls which are retained by the arming sleeve.

After firing.—On acceleration, the arming sleeve sets back and is retained by the larger stirrup spring which engages the circumferential groove, thereby freeing the two balls which move outwards under centrifugal action. Creep action is prevented by the smaller of the two stirrup springs.

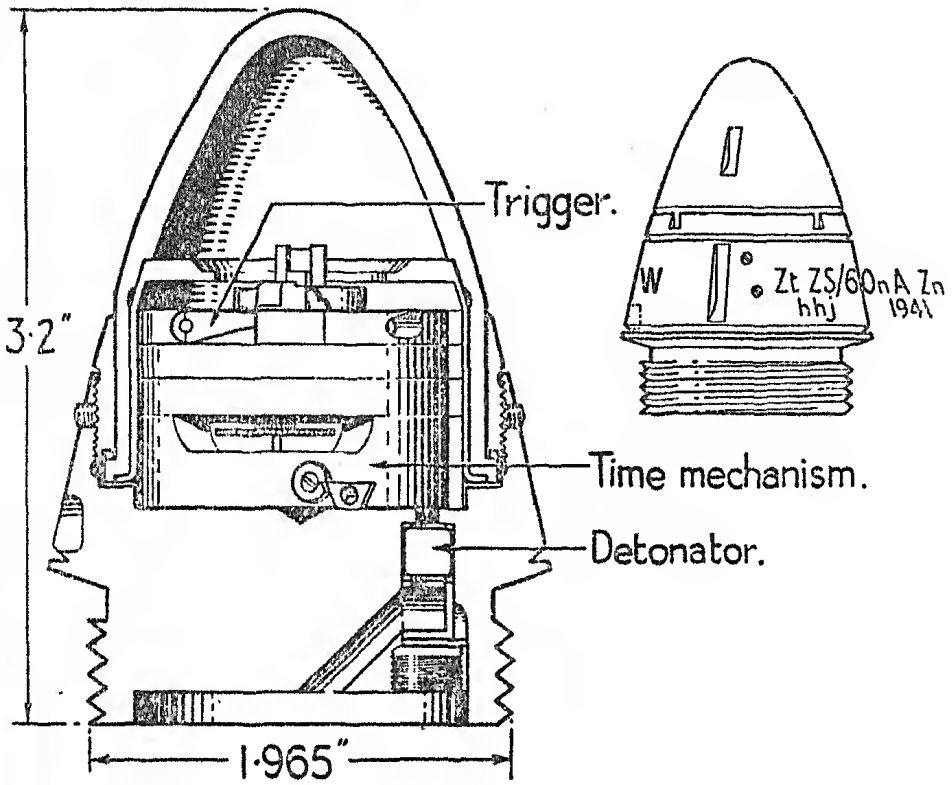
On impact or graze the inertia pellet moves forward on to the needle and detonates its filling.

GERMAN FUZE Zt. Z. S/60 nA Zn.

(Fig. 8)

This is a mechanical time fuze and is used in the 8·8 cm. Flak star shell. The fuze may be identified by the stamping "Zt. Z. S/60 nA. Zn." just above the flange and can be readily distinguished

GERMAN MECHANICAL TIME FUZE (Zt.Z.S/60nAZn).



TRIGGER ARRANGEMENT.

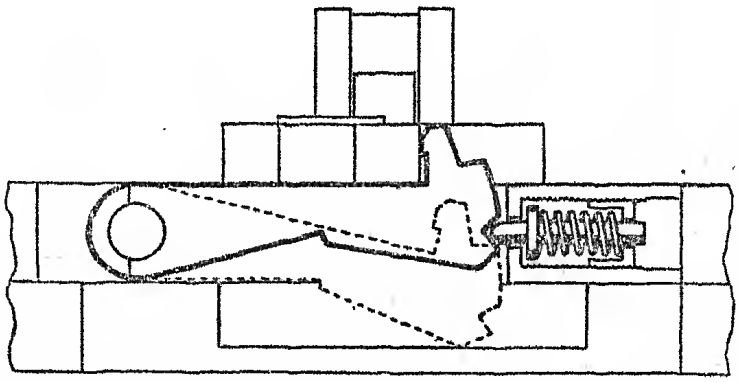


FIG. 8

from other German mechanical fuzes already described, by the low crh. of the fuze cap. Its maximum time of running is 60 seconds. The overall length of the fuze is 3·2 inches and it weighs 1 lb. 4 oz.

The body of the fuze is of zinc alloy, and the nose cap, hand race and screwed collar are of light alloy.

The time mechanism is similar to that of the Dopp.Z.S/60 S, described and illustrated in Pamphlet No. 10, but the hand is of light metal and the trigger plunger, supporting the trigger, is engaged in the end of the trigger instead of the outer side.

GERMAN 7·5 cm. PAK. 41 CARTRIDGE Q.F. A.P.B.C./T. SHOT (Pzgr. Patr. 41 H.K.)

This Q.F. fixed round is used in the 7·5 cm. anti-tank gun model 41. The overall length of the round is 28·8 inches and the weight 17 lb. 2 oz. The exterior of the shell, except the skirts is painted grey green on an undercoat of red. The edges and forward faces of the skirts appear to be treated with a graphitic coating, possibly to function as a lubricant.

The complete round consists of the following components.

A.P.B.C. shot with tungsten carbide core and tracer.
Case stamped with the model number 6344.
Propellant charge of double base composition with igniter.
Primer percussion C/12 nA. St.

Shot. Fig. 9

The total weight of the shot is 5 lb. 11¼ oz. It consists of a soft iron or steel body, a tungsten carbide core, and a ballistic cap with black plastic material between the cap and the core.

The body is in one piece with two collapsible skirts. The rear skirt is cannelured for the attachment of the case, and the forward skirt has 10 equidistant holes in it, each approximately 0·25 inch in diameter. Immediately in rear of the forward skirt the body is reduced in diameter. The body is bored centrally in two diameters to receive the core and tracer respectively and provided with a central hole for the escape of air when assembling the core. The hardness of the body is 90 to 110 V.D.H. with the exception of the tip at the forward end where, probably due to cold work, the hardness increased to 140/150 V.D.H. The density is 7·81 gm. per c.c.

The tungsten carbide core weighs 2 lb. and its density is 15·27 gm. per c.c. The core is coated with white paint before assembly, apparently to ensure a tight fit when pressed into the body. The nose of the core is embedded in a black plastic material which fills the space between the nose and the ballistic cap.

The steel ballistic cap is secured by turning the forward end of the body over its base to form a cannelure. Two holes are provided for the escape of the excess plastic during this operation.

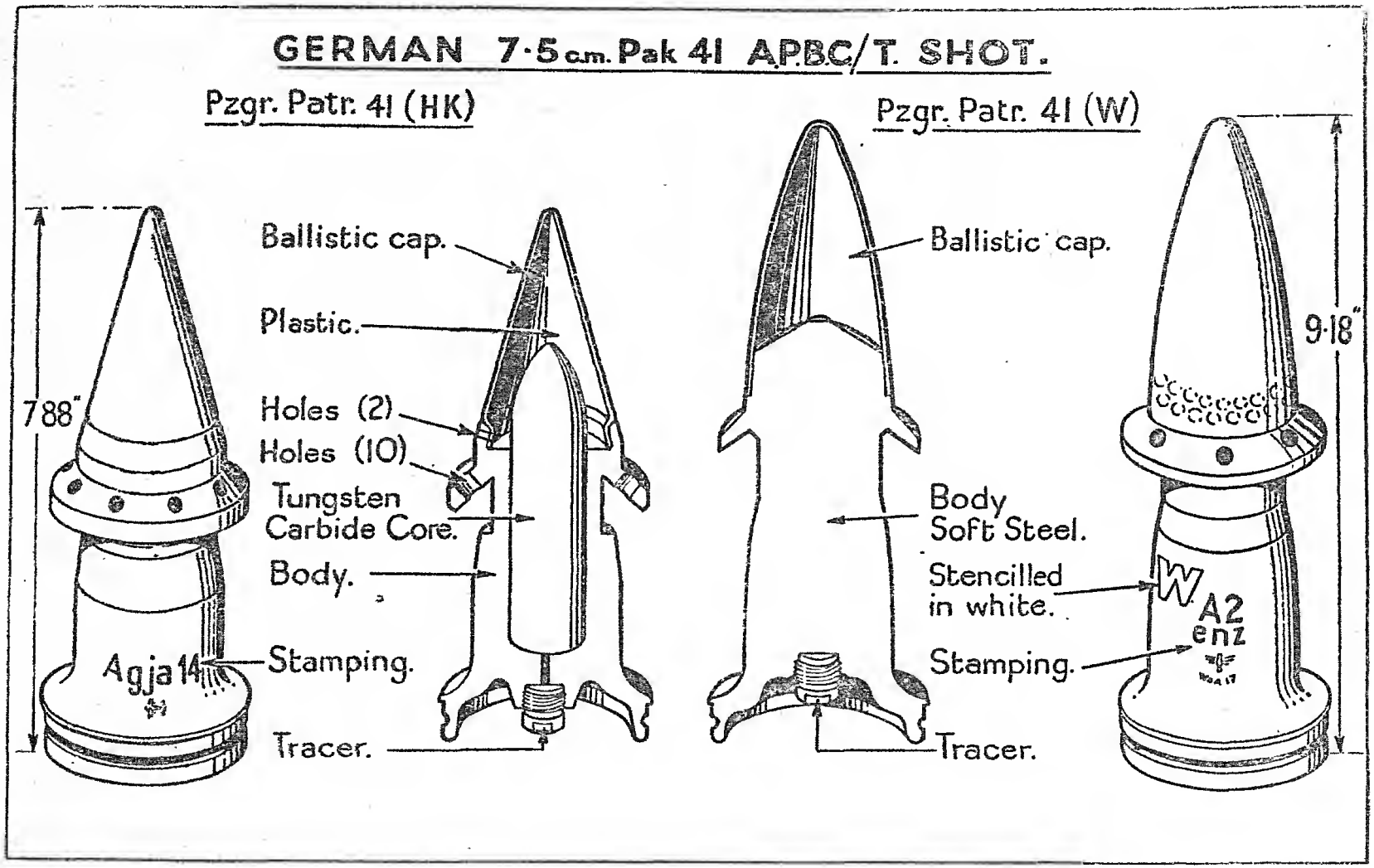

GERMAN 7·5 cm. Pak 41 APBC/T. SHOT.
Pzgr. Patr. 41 (HK)
7·88"
Agja 14
Ballistic cap.
Plastic.
Holes (2)
Holes (10)
Tungsten Carbide Core.
Body.
Stamping.
Tracer.
Pzgr. Patr. 41 (W)
Ballistic cap.
Body Soft Steel.
Stencilled in white.
Stamping.
Tracer.
9·18"
W A2 enz

FIG. 9 FIG. 10

Tracer

The tracer weighs 9½ drams. The body is of steel and is screw-threaded for insertion in the shot. The tracer composition is contained in a brass plated steel cup secured by turning over the lip of the body.

Propellant charge

The propellant charge weighs approximately 5 lb. 11 oz. and consists of tubular sticks of Digl. type in two lengths, 16·55 inches and 18·5 inches long respectively. The longer sticks weighing approximately 4 lb. 6½ oz. are contained in a white stocking bag tied at the top, the shorter sticks surround the bag and are not tied. The stocking is in two parts, stitched in the middle, and an igniter is sewn at one end. The stocking is centred by one or two cardboard washers, approximately 2 inches in internal diameter, at the top of the case.

The stocking examined was marked in black

7·5 cm. Pak 41
2·580 Kg.

$$\text{Digl. RP} - \text{G } 1{,}5 \left(\frac{420}{490} - 2{,}5/1\right)$$

dgb 1944/2
Bg. 8. 5. 43 E.

Case

The case is of steel, coated with brass, and is 21·4 inches in length. The base is stamped " 7·5 cm. Patrh. (6344) Pak 41," and stencilled in White " Pzgr. 41. H.K." The case examined was not stamped " St " as is usual with German steel cases. The details of the charge as marked on the bag are stencilled on the case.

Primer

The percussion primer C/12 nA. is described in Pamphlet No. 4, page 10. The letters " St " added to the designation indicate that the primer is of steel.

German 7·5 cm. Pak. 41 Cartridge Q.F. APBC/T Shot
(Pzgr. Patr. 41 W.)

This Q.F. fixed round is used in the 7·5 cm. anti-tank gun Model 41, as far as is known for practice only. The overall length of the round is 30 inches, and it weighs approximately 17 lb. The exterior of the shell including the ballistic cap is painted black, except the edges and forward faces of the skirts which appeared to be coated with a graphitic lubricant. The letter W is stencilled in white on the shot body.

The complete round consists of the following components :—

A.P.B.C. shot with tracer.
Case stamped with the model number 6344.
Propellant charge of double base composition with igniter.
Primer percussion C/12 nA St.

Shot. Fig. 10.

The total weight of the shot is 5 lb. 7½ oz. It consists of a solid soft steel shot with two skirts, tracer and ballistic cap. The skirts are integral with the shot. The rear skirt is cannelured circumferentially for the attachment of the case, and the base is bored centrally and screwthreaded internally to receive the tracer. Six equidistant holes approximately 0·24 inch in diameter are bored through the forward skirt. The hardness of the body is almost uniform between 90 and 110 V.D.H. The steel ballistic cap is attached to the shot by two rows of spot welds. The space between the nose of the shot and the ballistic cap is void.

The tracer is similar to that described in the Pzgr. Patr. 41 H.K. round.

Propellant charge case and primer

The propellant charge is similar to that described in the Pzgr. Patr. 41 H.K. round, excepting the diameter of the sticks and the weight of the short ones. The long sticks weighed 2,000 grams and the short ones 666 grams.

The stocking bag is marked in black.

7·5 cm. Pak. 41.
2670 g.

$$\text{Digl. RP—G } 1{,}5 \left(\frac{420}{490} - 2{,}7/1\right).$$

Ktz. 1942/8.
Bg. 8. 3. 43E.

The case and primer is the same as that described in the Pzgr. Patr. 41 H.K. round. The base of the case is stencilled in White " Pzgr. 41 W."

German Cartridge Q.F. 7·5 cm. Pak. 40 Hollow Charge Shell
(7·5 cm. Gr. Patr. 38 H1/B)

This round is of the fixed Q.F. type and is fired from the 7·5 cm. anti-tank gun Model 40. The overall length of the complete round is 38 inches and it weighs approximately 17 lb. 6 oz. The shell body and cap is painted deep olive and stencilled in black, except the stencilling FES which is in white.

The complete round consists of the following components :—

Shell hollow charge filled cyclonite/wax (95/5).
Fuze AZ 38.
Gaine Zdlg 40B.
Propellant charge of double base composition with igniter and flash reducer.
Case of steel coated with brass model 6340 St.
Primer percussion C/12 nA St.

Shell fuze and gaine

The filled shell and AZ 38 fuze are similar to that of the 7·5 cm. L.G. 40 hollow charge shell (Granate 38 H1/B), described in Pamphlet No. 8, pages 24 and 36, and illustrated in Figs. 10 and 15. The gaine is described is Pamphlet No. 13. The stencilling " FES " denotes that the driving band is of the sintered iron type containing (after the removal of the waxy material with which it was impregnated) carbon 0·06 per cent., silicon 0·02 per cent. manganese 0·21 per cent.

Propellant charge

The propellant charge is of the Gudol type in the form of square flakes, weighing approximately 14 oz. 13 dr. with a central tube of Digl. weighing approximately 2 oz. 2 dr. The mean size of the flakes is 0·156 inch × 0·156 inch × 0·22 inch, and the external and internal diameter of the tube 0·55 inch and 0·47 inch respectively. The charge is contained in a knitted viscose rayon bag with an igniter sewn to the base. The bag is marked in red " Auch für Tropen " and in black 7·5 cm. Pak. 40, 490g. Gu. Bl.P.—AO—(4 . 4 . 0,6).

The igniter consists of 40 grams Nz Man NP (1,5—1,5) in the form of chopped cord.

The compositions, as found by analysis, are as follows :—

Composition	Propellant per cent.	Central Stick per cent.	Igniter per cent.
Nitrocellulose	34·50	63·62	92·29
Nitroguanidine ...	30·27	—	—
Diethylene-glycol-dinitrate	34·17	32·33	5·73
Diphenylamine ...	—	0·23	0·45
Ethyl centralite ...	—	—	—
Sodium sulphate ...	0·62	—	—
Potassium sulphate ...	—	3·52	0·33
Graphite	0·44	0·30	1·20
Total ...	100·00	100·00	100·00

The flash reducer consists of 20 grams of potassium sulphate and is contained in a separate bag of knitted cellulosic material. The bag is stencilled 20g. K_2SO_4.

Case

The case is of steel, coated with brass, and is 28·1 inches in length. The base is stamped with the model number " 6340 St. 7·5 cm. Pak. 40 " and stencilled in white " FES ". Details of the charge as marked on the cartridge bag are stencilled on the case.

Primer

The percussion primer C/12 nA is described in Pamphlet No. 4, page 10. The letters " St " added to the designation indicate that the primer is of steel.

GERMAN CARTRIDGE Q.F. 7·62 cm. Pak 36 APBC/T. SHOT WITH T.C. CORE

(7·62 cm. Panzergranat-Patrone 40)

This cartridge is used with the 7·62 cm. Pak 36 anti-tank gun. The overall length of the complete round is approximately 36·7 inches and it weighs 19 lb. 9½ oz. The shot is painted black and stencilled in red except the white letters " KPS " denoting that the driving band is iron covered with copper. The cartridge case is stamped in the base " 6340 St. 7·5 Pak 40 " and apparently is a converted case. The complete round for the 7·62 Pak 36 may, however, be readily identified by the white tip 1·58 inches long on the ballistic cap.

The fixed Q.F. Cartridge consists of the following components :—

APBC Shot with T.C. Core
Tracer
Brass Case or steel case coated with brass
Propellant charge
Percussion primer C/12 nA. St.

Shot (Panzergranate 40) Fig. 11

The Shot with its ballistic cap is 9.45 inches in length and, without tracer, weighs 8 lb. 10 oz. The steel body is a machined forging, and that portion of the cavity surface forming a housing for the plastic is coarsely machined probably to make a good bond with the plastic. It is screwthreaded in the base to receive a core holder and externally at the shoulder to receive a ring adapter securing the ballistic cap. The base is recessed to form a cannelure when the core holder is assembled.

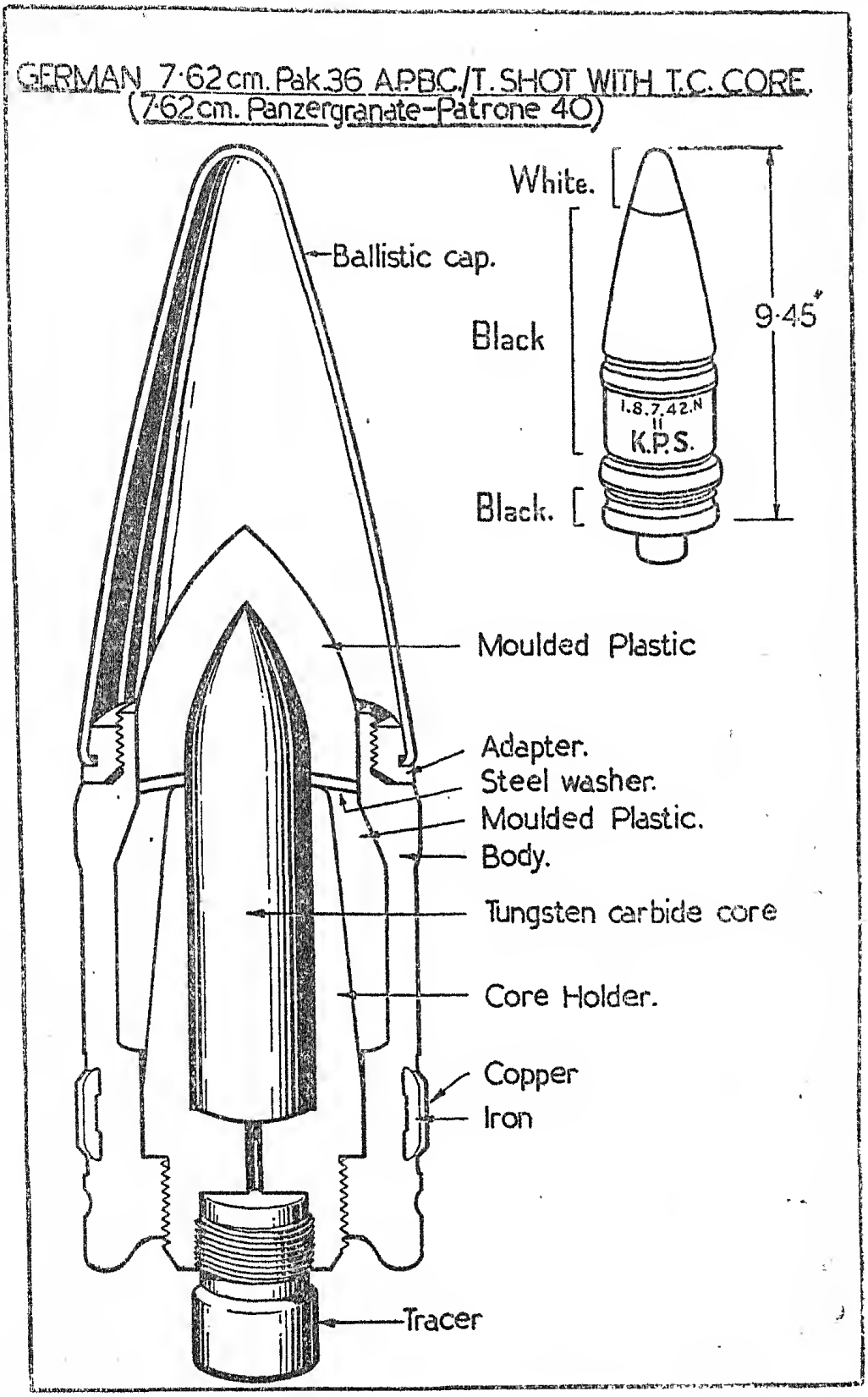

GERMAN 7·62 cm. Pak 36 A.P.B.C./T. SHOT WITH T.C. CORE.
(7·62 cm. Panzergranate-Patrone 40)
White.
Ballistic cap.
Black
9·45"
I.8.7.42.N
II
K.P.S.
Black.
Moulded Plastic
Adapter.
Steel washer.
Moulded Plastic.
Body.
Tungsten carbide core
Core Holder.
Copper
Iron
Tracer

FIG. 11

The single driving band is of soft iron with a coating of copper. A cannelure for the attachment of the case is formed in rear of the driving band.

The core holder is of steel, and is bored centrally in two diameters to form a diaphragm separating two recesses. The forward recess receives the tungsten carbide core whilst that in the base is screw-threaded to receive the tracer. The diaphragm is bored centrally to allow the air to escape when the core is inserted. Externally, at the forward end, the holder is tapered and roughly machined similar to the cavity surface of the shell body and presumably for the same purpose.

The tungsten carbide core weighs 1·99 lb.

The head of the core and its holder are surrounded by moulded plastic which fills the space between the body and these components. The plastic has an ogival head of low crh. under the ballistic cap.

A reinforcing washer, stamped from cold rolled mild steel strip, approximately 0·12 inches thick, is inserted in the plastic to seat on the forward end of the core holder and surround the core at about its shoulder.

The ballistic cap is pressed from mild steel sheet and is crimped into a cannelure in a mild steel adapting ring which screws on to the shoulder of the shell body.

Tracer

The tracer is described as a separate item in this pamphlet.

Cartridge case

The case is of steel coated with brass and is 28·1 inches in length. The base is stamped with the model number "6340 St." This model number is also stamped on the 7·5 cm. Pak 40 cases, described in Pamphlet No. 7, pages 50 and 52, which are only 26·2 inches in length.

Propellant charge and igniter

The propellant charge weighs approximately 4 lb. 9 oz. and consists of grey tubular Gudol sticks 24·5 inches in length with a mean internal and external diameter of 0·193 inches and 0·076 inches respectively. An analysis of the propellant shows that it consists of nitrocellulose 36·48 per cent. diethylene-glycol-dinitrate 28·20 per cent. nitroguanidine 34·05 per cent. potassium sulphate 1·16 per cent. and graphite 0·11 per cent. It is contained in a knitted fabric bag with an igniter in a stitched pocket at one end. The bag is stencilled in red "Fur Tropen" and in black "7·62 cm. Pak. 36 2,070 Kg. GU.R.P. AO,5—(625 . 5/2).

The igniter consists of 20 grams of Nz.Man.NP in the form of chopped cord. It consists of nitrocellulose 86·67 per cent.

diethylene-glycol-dinitrate 9·53 per cent. diphenylamine 0·42 per cent. ethyl centralite 0·83 per cent. graphite 0·70 per cent. potassium sulphate 0·25 per cent. and camphor 1·60 per cent.

A flash reducer consisting of 1 oz. 2 dr. of potassium sulphate in a ring shaped fabric bag is added to the charge.

Primer

The percussion primer C/12 nA is described in Pamphlet No. 4, page 10.

GERMAN CARTRIDGE Q.F. 7·62 cm. Pak 36 APCBC/T. SHELL

(7·62 Panzergranat-Patrone 39)

The cartridge is used in the 7·62 cm. Pak 36 anti-tank gun. The overall length of the complete round is approximately 39·2 inches, and it weighs 28 lb. 4 oz. The shell is painted black and stencilled in red, and also a red band painted immediately in front of the driving band. A white tip 1·58 inches long on the ballistic cap readily distinguishes the round from that used in the 7·5 cm. Pak 40 gun which fires a round with a cartridge case bearing a similar case model number stamped in the base. The case is stamped " 6340 St Pak 44 Rh."

The fixed Q.F. cartridge consists of the following components :—

Shell APCBC.
Base fuze Bd Z 5103* with tracer.
Brass case or steel case coated with brass.
Propellant charge
Percussion primer C/12 nA St.

Shell. Fig. 12

The filled shell with fuze and tracer weighs 16 lb. and the design is similar to the 7·5 Pak 40 APCBC shell illustrated in Pamphlet No. 7, page 51. The bursting charge consists of 9½ drams of cyclonite wax 90/10. The single driving band is of the copper-iron type. The piercing cap is soldered to the ogival part of the body, and the ballistic cap, approximately 0·06 inches thick, is attached to the penetrative cap by a circumferential deposit of weld metal, the excess of which is removed by grinding.

Fuze, gaine and tracer

The base fuze Bd Z 5103* with gaine is described in Pamphlet No. 4, pages 14 and 15, which includes an illustration in Fig. 8.

The tracer is described as a separate item in this pamphlet.

Cartridge case

The case is similar to that of the APBC/T Shot round described in this pamphlet, except that the base of the round examined was

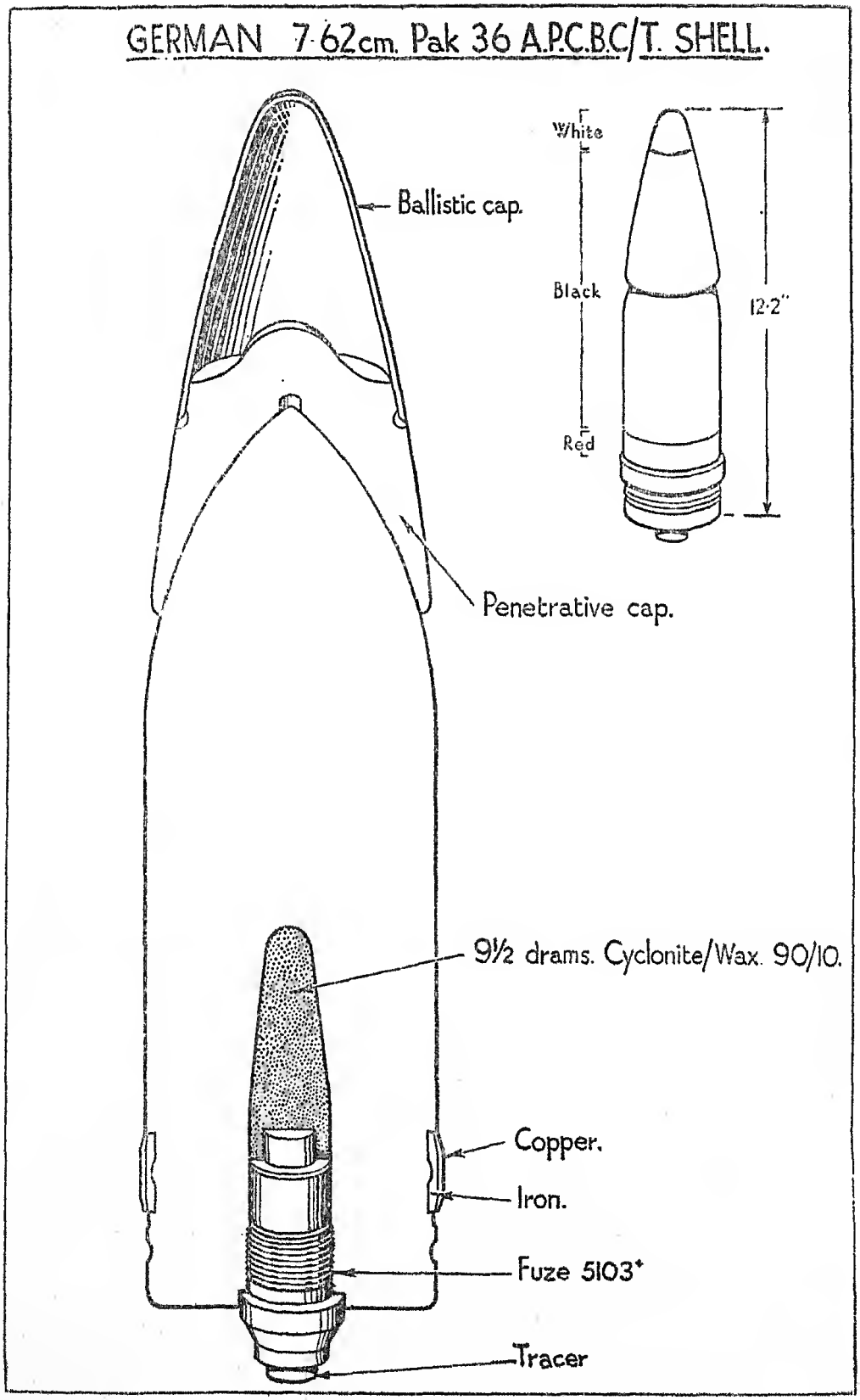

GERMAN 7·62cm. Pak 36 A.P.C.B.C/T. SHELL.
White
Black
Red
12·2"
Ballistic cap.
Penetrative cap.
9½ drams. Cyclonite/Wax. 90/10.
Copper.
Iron.
Fuze 5103*
Tracer

FIG. 12

stamped " 6340 St Pak 44 Rh " and apparently it was intended originally for a Pak 44 equipment. The case is stencilled in red " Fur Tropen, P.T. + 25°C " and, in black, particulars of the propellant charge identical to that stencilled on the bag containing the propellant charge.

Propellant charge and igniter

The propellant charge weighs approximately 5 lb. 7 oz. 7½ dr. and consists of dark tubular sticks of Digl. type 24·3 inches in length, with a mean external and internal diameter of 0·175 inches and 0·056 inches respectively. An analysis of the propellant shows it consisted of nitrocellulose 63·44 per cent. diethylene-glycol-dinitrate 25·79 per cent., ethyl centralite 9·60 per cent., potassium sulphate 0·91 per cent., and graphite 0·26 per cent. The charge is wholly contained in a knitted fabric bag with an igniter in a stitched pocket at one end. The bag is stencilled in red " Fur Tropen " and in black 7·62 cm. Pak 36. 2,480 Kg. Digl. R.P. G-O (625—3,8/1,3).

The igniter consists of 20 grams of Nz.Man. NP in the form of chopped cord. An analysis shows that it consists of nitrocellulose 92·06 per cent., diethylene-glycol-dinitrate 7·10 per cent., and diphenylamine 0·84 per cent.

Primer

The percussion primer C/12 nA is similar to that described in Pamphlet No. 4, page 10, and illustrated in Fig. 4, excepting the cap composition which consists of barium nitrate 50·9 per cent., lead styphnate 22·2 per cent., antimony sulphide 7·2 per cent., and calcium silicide 19·7 per cent., and possibly a very small quantity of tetrazene as a sensitizing agent. The weight of the composition is 0·44 grains.

GERMAN 8·8 cm. FLAK 41 CARTRIDGE Q.F.H.E. SHELL 8·8 cm. Sprgr. Patr. L/4,7 (FES)

This fixed Q.F. round is fired from the 8·8 cm. Flak 41 gun. The weight of the complete round is 44 lb. 12 oz. and its overall length 47·2 inches.

The complete round consists of the following components :—

H.E. shell filled amatol (40/60).
Fuze Zt Z S/30 Fgl or AZ 23/28.
Gaine C/98 of the larger size.
Brass case.
Propellant charge of double base flashless propellant.
Primer electric C/22.

Shell

The weight of the shell filled and fuzed is approximately 20 lb. 8 oz. The shell is painted yellow and stencilled in black. The numeral " 13 " stencilled on the shell shoulder indicates the bursting charge is amatol 40/60 which weighs approximately 1·9 lb. The shell is streamlined, has a solid base, and is fitted with two soft iron driving bands and an exploder container carrying the gaine " Gr Zdlg C/98."

Fuzes and gaine

Details of fuze Zt Z S/30 Fg[1] are given in Pamphlet No. 8, page 16, and the gaine Gr Zdlg C/98 in Pamphlet No. 6, page 14.

Cartridge case and primer

The cartridge case and primer are identical to that used with the APCBC/T round described in Pamphlet No. 13.

Propellant charge and igniter

The propellant is flashless, and basically of the same composition as that used in the APCBC/T cartridge. It is tubular in form but of slightly different size as indicated by the markings stencilled on the case. The bag containing the charge has an igniter containing 20 grams of nitrocellulose powder sewn to its base. The weight of the charge as indicated by the stencilling on the case is 5,355 kg. (13 lb. 13 oz.) and the stencilling " TROPEN " on the case indicates that the charge is suitable for hot climates. The designation indicating the nature and size of the propellant, as stencilled on the case, is " Gu. R.P. — KN — (740 — 4,2/1,5) ".

GERMAN 8·8 cm. FLAK STAR SHELL

(Fig. 13)

The shell is of the base ejection type and is of conventional design. The filled shell with fuze weighs approximately 20 lb. 6 oz. and its overall length is 15·57 inches. It is fitted with two driving bands and is painted a light green with a black tip immediately below the fuze. The shell is not cannelured for the attachment of the case. The shell examined was stencilled in white " rdf V1. 41 ". The fuze Zt.Z.S/60 nA Zn is described as a separate item in this pamphlet.

The shell body is formed with a diaphragm at the head end which is bored centrally and screwthreaded to receive a primer. The recess above the diaphragm is screwthreaded to receive the fuze which is secured by a grub screw.

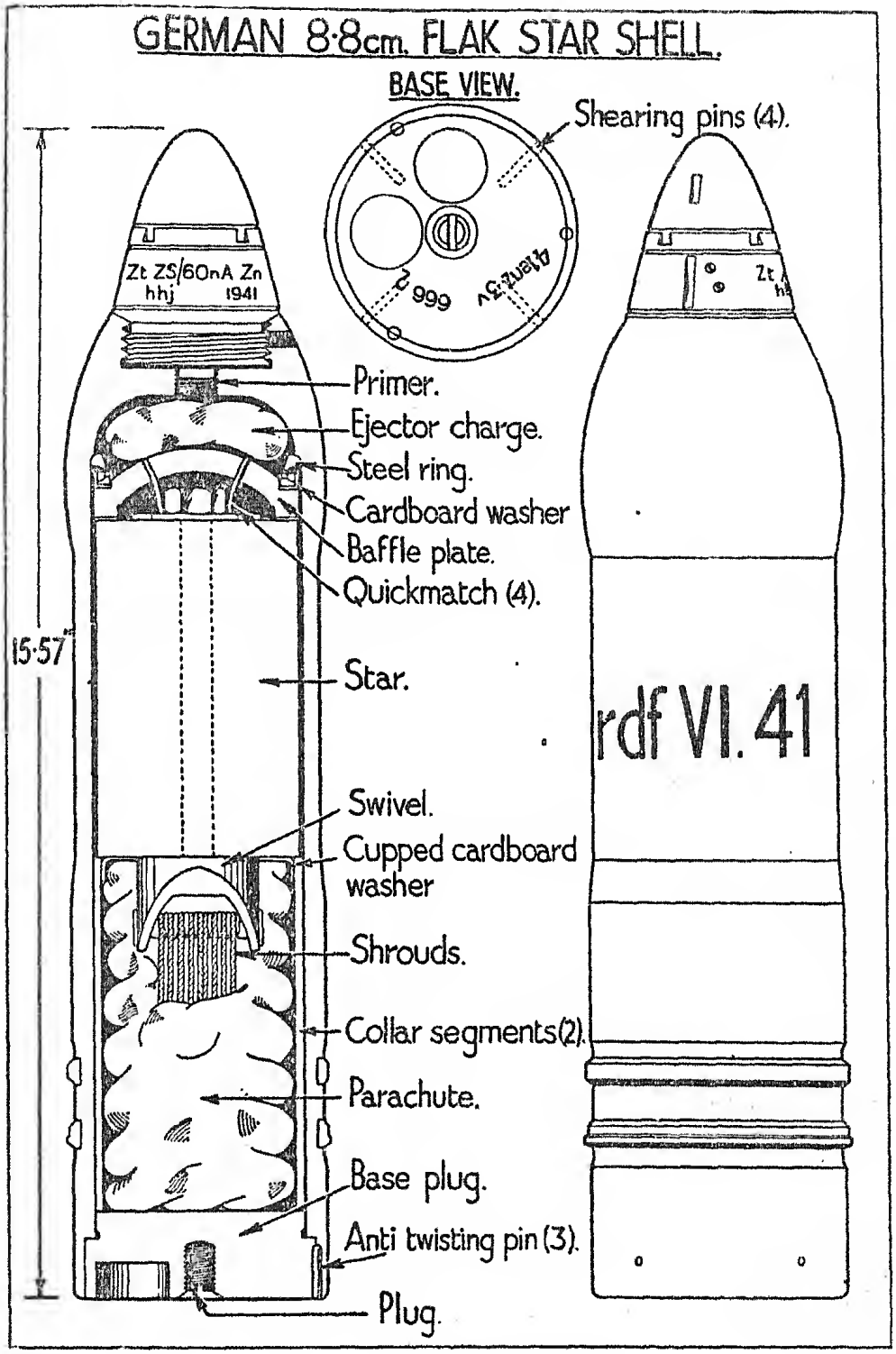

GERMAN 8·8cm. FLAK STAR SHELL.
BASE VIEW.
Shearing pins (4).
Zt ZS/60nA Zn
hhj 1941
Primer.
Ejector charge.
Steel ring.
Cardboard washer
Baffle plate.
Quickmatch (4).
15·57"
Star.
Swivel.
Cupped cardboard washer
Shrouds.
Collar segments (2).
Parachute.
Base plug.
Anti twisting pin (3).
Plug.
rdf VI. 41

FIG. 13

The primer is a hollow screwed brass plug, approximately 0·4 inches internal diameter, with a small hole approximately 0·15 inches in diameter in the base. It contains a perforated gunpowder pellet weighing 0·6 drams resting on a disc of tinfoil. The plug is closed by a tinfoil disc secured by a brass washer approximately 0·3 inches internal diameter.

The ejector charge, accommodated immediately below the diaphragm, consists of two circular bags approximately 3·5 inches in diameter, one is of red shalloon, quilted and stitched to the second which is of white flannel. Both bags contain a total of approximately 13½ drams of gunpowder.

The baffle plate is dome-shaped and has a circumferential shoulder formed on its upper edge. It is accommodated, dome upwards, immediately below the ejector charge. The plate is bored with four equidistant holes which communicate between the ejector charge and the star chamber.

A perforated steel ring above a cupped cardboard washer is fitted between the shoulder of the plate and a shoulder at the head of the shell cavity.

Four lengths of quickmatch transfer the flash from the ejector charge to ignite the star. One end of the quickmatch is secured by wax in each of the holes of the baffle plate whilst the other end is secured by wax in the priming pellet in the star.

The star consists mainly of a steel cylinder, steel disc, bolt, swivel, asbestos fire tube, steel washer, cardboard washer, nut, priming composition and star composition.

The cylinder is closed at the base end by a steel disc which is screwthreaded to receive the bolt and is partly closed at the top by a steel supporting washer and a cardboard washer.

The bolt head supports the swivel, and is screwthreaded under the head to suit the steel disc. The bolt is passed through the centre of the star which is lined with an asbestos fibre tube and is secured by its nut to the steel supporting washer.

The star composition, weighing approximately 2·2 lb., consists of two cylindrical pellets with a central perforation through which the bolt passes. The first 0·1 inch of the pellet, at the open end, consists of composition mixed with grained gunpowder. This is primed by means of four pellets, each weighing 1·5 grams, surrounding the ends of the quickmatch. Beneath each pellet is a conical hole containing 0·2 grams of loose priming composition.

The star has a time of burning, at rest, of approximately 23 seconds, and a light intensity of approximately 375,000 candles.

The compositions, as found by analysis, consist of :—

	Per cent.		
	Main filling	Priming pellets	Intermediate priming
Magnesium	33·7	1·4	70·8
Barium nitrate	47·3	—	1·2
Sulphur	14·9	6·6	1·9
Grease	2·9	8·3	4·2
Potassium nitrate ...	—	68·5	17·9
Charcoal	—	15·2	—
Nitrocellulose	—	—	4·0
Residue (insol.)	1·2	—	—
	100·0	100·0	100·0

Parachute

The parachute is 22 inches in diameter and has a vent 2 inches in diameter at the top. It consists of eight sections of flax fabric sewn together and reinforced along the seams by means of linen tape. Two other circular bands of tape strengthen the parachute, one around the circumference and the other about 3 inches from the circumference.

There are eight shrouds consisting of four lengths of steel cable, which are looped through the swivel attached to the star, so that the shrouds diametrically opposite are continuous cable. Each end is passed through a steel eyelet in the circumference of the parachute where it is knotted and then passed through five more eyelets situated in the radial seam of the parachute. Another steel cable extends from the swivel to the vent of the parachute where it is tied to the crossed cable. Other steel cables are passed along the circular strengthening tapes in the parachute and are knotted to the radial cables where these crossed.

The parachute is accommodated in two steel collar segments which line the shell cavity. The segments support the star container. A cupped cardboard washer is inserted between the parachute and star container.

The base of the shell is closed by a steel plug with a shoulder which fits against an internal shoulder in the shell cavity. It is secured by four equidistant radial copper shear pins. The shearing of these pins by rotational action is prevented by three steel twisting pins inserted longitudinally between the rim of the plug and the shell body. The base of the plug is bored centrally and screw-threaded to enable a tracer to be fitted.

Action

The ignition of the ejection charge is initiated by the fuze through the primer. Pressure set up on the baffle plate is transmitted through the star cylinder and parachute protecting segments to the base plug thereby causing the shearing pins to break and the whole to be ejected. At the same time, the quickmatch is ignited and after a short interval which allows time for the parachute to open, ignition of the star composition takes place.

GERMAN 10 cm. leF.H.18 HOLLOW CHARGE SHELL (10 cm. Gr. 39 rot. Hl/A, Hl/B and Hl/C)

(Fig. 14)

A 10 cm. leF.H.18 hollow charge shell, designated " 10 cm. Gr. 39 rot Hl " is described in Pamphlet No. 8 and illustrated in Fig. 20. Shell of later design with a letter " A ", " B " or " C " added to the abbreviation " Hl ", are illustrated in Fig. 14. These shell differ from the former design mainly in the shape of the shell cap, filling, shape of the hollow cavity in the bursting charge and the model of the gaine. The shell bodies of the latter three types are similar, but differ in the method of securing the cap as shown in Fig. 14. The overall length of the shell, with fuze, is 19·75 inches. The present standard issue is design Hl/C.

The fuze used in each is the AZ 38 described in Pamphlet No. 8 and illustrated in Fig. 10. The gaine " Zundladung 41 " is described in Pamphlet No. 13.

Shell design " Hl/A "

The weight of the shell filled and fuzed is 26 lb. 14½ oz. The wall of the shell is comparatively thin, and the cavity for the bursting charge tapers towards the base. An internal screwthread is formed at the front end to receive the base of the cap which is secured by a rivet. The cap is of greater crh than that of the shell of original design. The single driving band is 0·59 inches wide and of the ferrous type.

The bursting charge, indicated by the numeral " 95 " stencilled on the shell body, is cyclonite, T.N.T. and wax, the percentage of each being approximately 57, 40 and 3 respectively. It weighs 3 lb. 4 oz. 9 dr. and is in three blocks. The blocks are contained in a waxed paper carton and are secured to the shell by a bituminous composition lining the walls. A blue label, printed in black, and affixed to the carton, reads as follows :—

Sprengladung
der 10 cm Gr 39
H.5 (SH) krl 1941
Fp 02 (umkr) elg 1941
rdf 95 93/1941

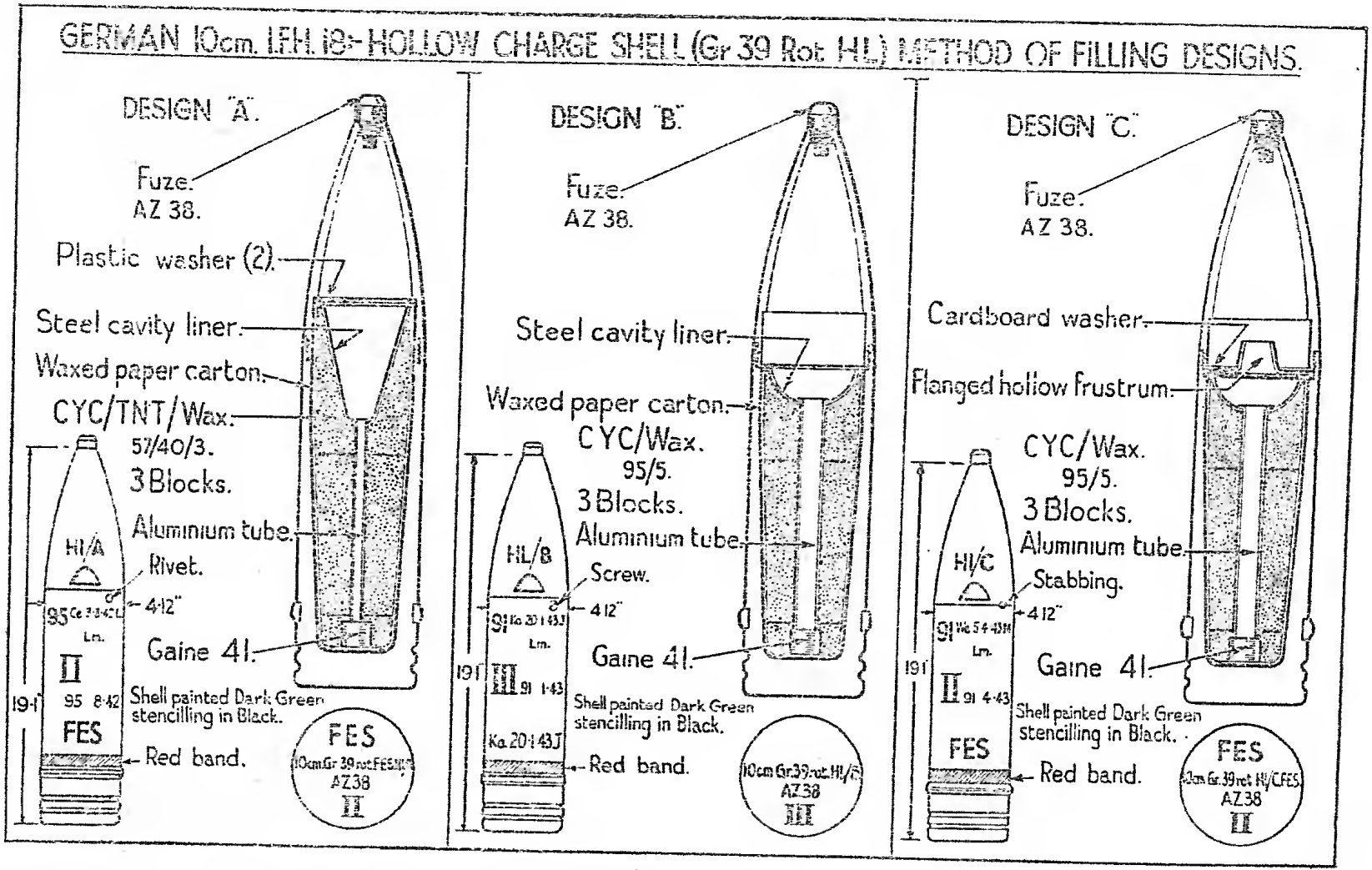

GERMAN 10cm. LFH. 18- HOLLOW CHARGE SHELL (Gr 39 Rot. HL) METHOD OF FILLING DESIGNS.
DESIGN "A".
Fuze. AZ 38.
Plastic washer (2).
Steel cavity liner.
Waxed paper carton.
CYC/TNT/Wax. 57/40/3.
3 Blocks.
Aluminium tube.
Rivet.
4·12"
Gaine 41.
Shell painted Dark Green stencilling in Black.
Red band.
HI/A
95
Lm.
II
95 8-42
FES
19·1"
FES 10cmGr 39 rot FES/II AZ38 II
DESIGN "B".
Fuze. AZ 38.
Steel cavity liner.
Waxed paper carton.
CYC/Wax. 95/5.
3 Blocks.
Aluminium tube.
Screw.
4·12"
Gaine 41.
Shell painted Dark Green stencilling in Black.
Red band.
HL/B
Lm.
III 91 1-43
Ka 20 1 43 J
19·1"
10cm Gr 39 rot HL/B AZ38 III
DESIGN "C".
Fuze. AZ 38.
Cardboard washer.
Flanged hollow frustrum.
CYC/Wax. 95/5.
3 Blocks.
Aluminium tube.
Stabbing.
4·12"
Gaine 41.
Shell painted Dark Green stencilling in Black.
Red band.
HI/C
Lm.
II 91 4-43
FES
19·1"
FES 10cm Gr 39 rot HI/CFES AZ38 II

FIG. 14

A central channel, in two diameters, is formed in the blocks to accommodate the gaine in the base and above it an aluminium tube approximately 0·4 inches in diameter. The top block is formed with a coned cavity in which is fitted a steel liner. The liner is attached to the upper end of the tube. Two plastic washers are fitted between the top of the liner and an internal shoulder in the cap.

Shell design " Hl/B "

The weight of the shell filled and fuzed is 26 lb. 10 oz. The shell body and cap is similar to the " Hl/A " excepting that the cap is secured by a screw.

The bursting charge, as indicated by the numeral " 91 " stencilled on the shell body is cyclonite/wax (95/5). It weighs 3 lb. 4 oz. 9 dr. and is in three blocks. The charge, which does not extend into the cap, is contained in a paper carton which is secured to the wall of the shell cavity by a bituminous composition. A label, similar to that on the Hl/A charge, is affixed to the carton and reads as follows :—

	Sprldg	
d. 10 cm.	Gr 39	Hl/B
versch	H.5	42
cwg.	91	541/42

A central channel, in two diameters, is formed in the blocks to accommodate the gaine in the base, and above it an aluminium tube. The top block is formed with a saucer shaped cavity in which is fitted a steel liner. The tube is approximately 0·71 inches in diameter, and the liner is attached to its upper end. The cap is screwed on to the body metal to metal, and there were no plastic or cardboard washers fitted.

Shell design " Hl/C "

The weight of the shell filled and fuzed is 26 lb. 13 oz. The bursting charge, cavity liner and aluminium tube are similar to those in the " Hl/B " shell except that the top half of the shell cavity and carton was coated with bituminous composition and the lower half with oxychloride cement, and the label read " 43 " for " 42 " and " 55/43 " for " 541/42 ". A steel flanged hollow frustrum, weighing 8 oz. 5 dr. with a cardboard washer stuck to the upper side of the flange, is fitted above the liner. It is secured between the shoulder in the shell body and the base of the cap.

GERMAN 15 cm. (NAVAL) A.P.B.C. SHELL

(Fig. 15)

This is a naval shell and is fired with a separate loading Q.F. cartridge. The approximate length of the shell is 24·8 inches and its weight filled and fuzed is approximately 99 lb.

The exterior of the shell is painted yellow and stencilled in black and has a black painted tip on the ballistic cap. A large arrow on the ballistic cap, painted in black and pointing towards the base, readily distinguishes this shell with a base fuze from the H.E. shell which is similarly marked but has a nose fuze under the ballistic cap. The shell is fitted with two copper driving bands and, immediately behind the driving bands, a lead ring which acts as a decoppering agent. The light ballistic cap is screwed on to an adapter secured to the shoulder of the shell body.

External markings on the shell are shown in Fig. 15.

The base of the shell cavity is screwthreaded to receive a flanged base adapter which screws on to a lead washer fitting against a shoulder formed in the shell cavity below the tread. The adapter is screwthreaded internally to receive a steel container, for the gaine and fuze, which extends into a cavity in the bursting charge.

The bursting charge weighs 4 lb. 7½ oz. and consists of five pressed blocks of T.N.T./Wax corresponding in setting point to Service Grade 1. Between the whole charge and the walls of the shell are two sheets of paper. The forward block consists of 6 oz. TNT/Wax 75/25 in an aluminium container suitably shaped to fit the upper end of the shell cavity. The remaining blocks are contained in a cardboard carton and consist of two upper blocks of 13 oz. TNT/Wax 80/20 and 1 lb. 0½ oz. TNT/Wax 85/15 respectively, followed by two blocks consisting of 2 lb. 4 oz. TNT/Wax 95/5. The upper of the lower two blocks has a base cavity which, with the annular shaped lower block, forms a suitably shaped cavity to receive the steel exploder container.

Cardboard washers are fitted between the base adapter and the base of the filling in order that the filling may be held securely in the shell cavity.

Labels and stencilling on the filling were found as under :—

Label on the nose pellet :—

Zweiteilige Sprengladung fur
15 cm Spgr L/4, 2u. L/4, 3 Bdz (m.Hb)
Nr 313 St 5114 (37/40a) ul
0,170 kg Fp 25 — elg umkr 40
Gefertigt : rdf 40 Lief 1.

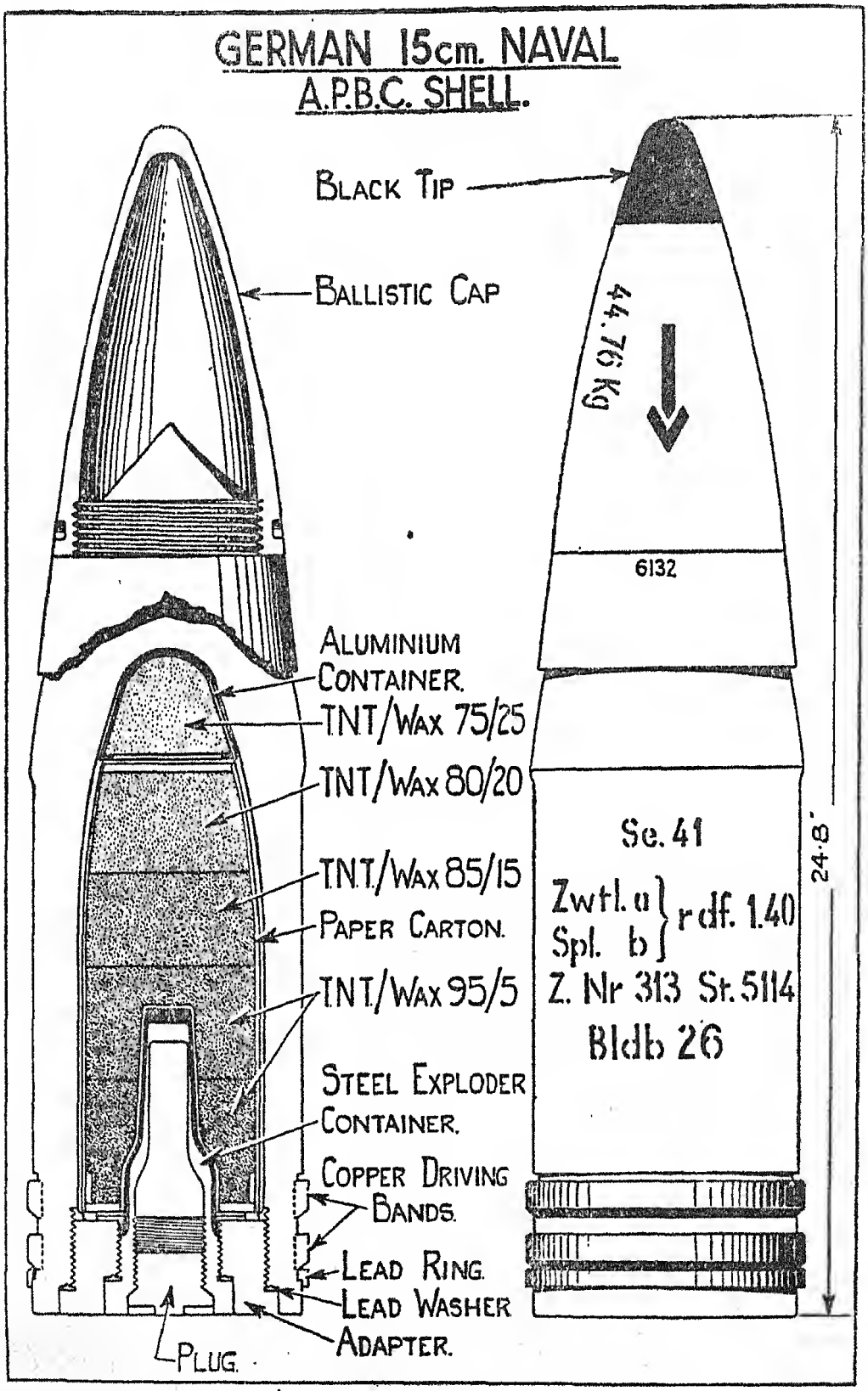

GERMAN 15cm. NAVAL
A.P.B.C. SHELL.
BLACK TIP
BALLISTIC CAP
ALUMINIUM CONTAINER.
TNT/WAX 75/25
TNT/WAX 80/20
T.N.T./WAX 85/15
PAPER CARTON.
T.N.T./WAX 95/5
STEEL EXPLODER CONTAINER.
COPPER DRIVING BANDS.
LEAD RING.
LEAD WASHER
ADAPTER.
PLUG.
44.76 Kg
6132
Se. 41
Zwtl. a } rdf. 1.40
Spl. b }
Z. Nr 313 St. 5114
Bldb 26
24·8"

FIG. 15

Label on side of cardboard container :—

Zweiteilige Sprengladung fur
15 cm Spgr L/4,2u. L/4, 3 Bdz (m.Hb)
Nr 313 St 5114 (37/40A)u2
0,370 kg Fp 20
0,470 kg Fp 15 } —elg umkr. 40
1,020 kg Fp 5
Gefertigt : rdf 40 Lief 1.

Stencilled on cardboard container :—

Marine Abnahmestelle
(Eagle)
11/9

Label on base of cardboard container :—

Zweit. Sprengladung f 15 cm Spgr L/4,2u L/4, 3 Bdz.
m (Hb) Nr 313 St 5114 (37/40 a)
0,170 kg Fp 25, 0,370 kg Fp 20, 0,470 kg Fp 15
1,020 kg Fp 5
elg umkr 40, Gefertigt ; rdf 40 Lief 1.

Gaine

The gaine in the exploder container is the large size C/98 described in Pamphlet No. 6, page 14.

Fuze

The fuze which is the Bdz C/38, is described as a separate item in this pamphlet.

GERMAN 15 cm. H.E.B.C. SHELL
(15 cm Sprgr L/4·6 m. Haube)
(Fig. 16)

This is a naval type of shell. It is fired with a separate loading Q.F. cartridge and fuzed with either the Kz.C/27 or M. Dopp.Z.S/90 type of fuze.

The exterior of the shell is painted yellow and stencilled in black and has a black tip painted on the ballistic cap. A large arrow on the ballistic cap, painted in black and pointing towards the nose, readily distinguishes this shell from the A.P.C.B.C. shell described in

GERMAN 15cm NAVAL H.E. B.C. SHELL

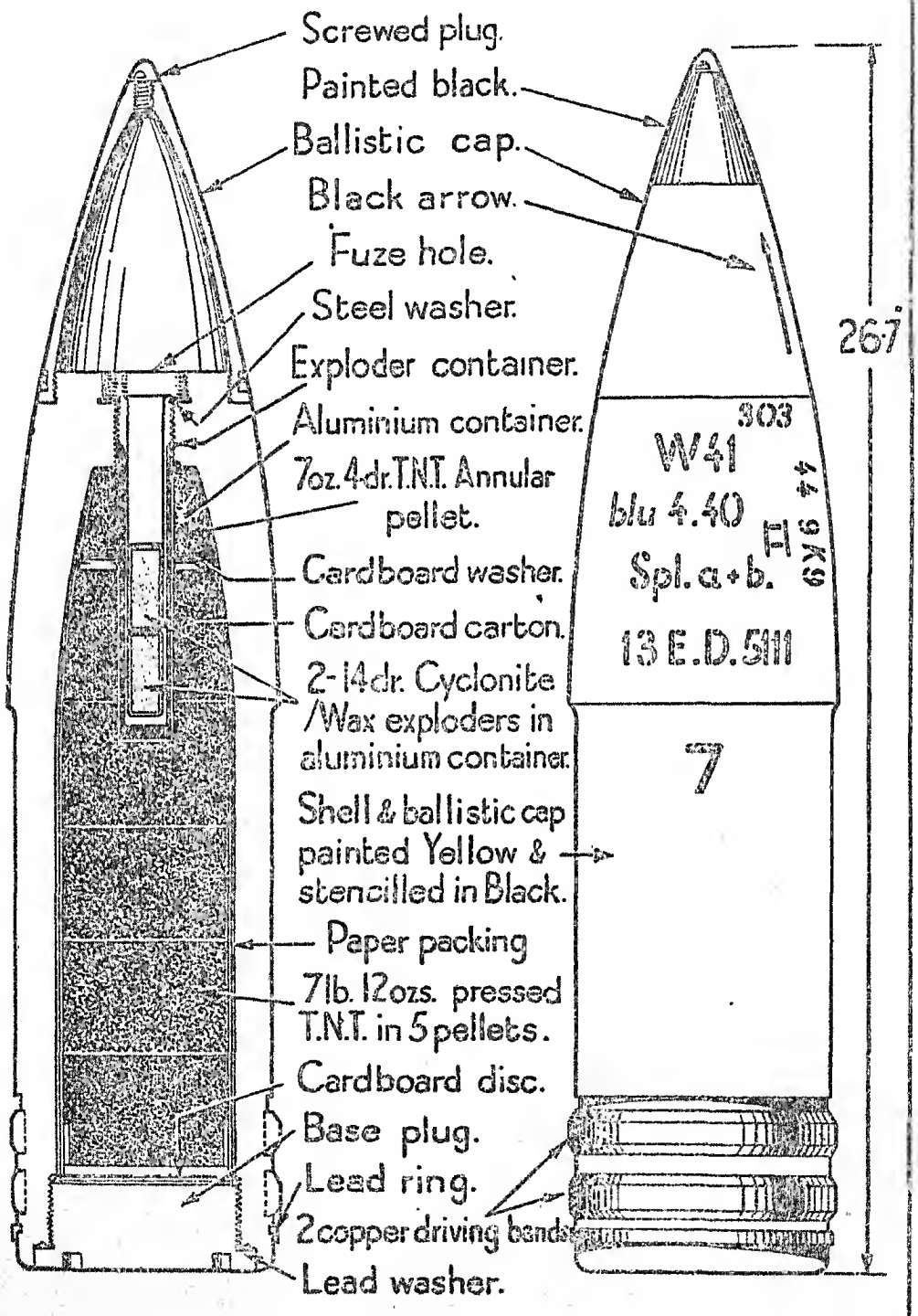


FIG. 16

this pamphlet. The shell is fitted with two copper driving bands and immediately behind them towards the base is a lead ring which acts as a decoppering agent. The overall length of the shell is 26·7 inches and its weight filled is approximately 100 lb. The shell is not issued fuzed. External markings on the shell are shown in Fig. 16.

The forward end of the shell body is screwthreaded externally to receive a light ballistic cap, and internally in two diameters to receive a long steel exploder container below the fuze.

The ballistic cap screws on to a shoulder and continues the external contour of the shell to the front. The cap has an aperture in the nose which is screwthreaded and closed by a screwed plug. A wooden distance piece, not shown in the drawing, extends from below the plug into the exploder container to retain the exploders in position during transportation.

The lower half of the steel container holds two small exploders each consisting of 14 dr. pellets of pressed cyclonite/wax 90/10 in aluminium cylinders.

The bursting charge consists of 8 lb. 3 oz. 4 dr. of TNT/Wax in six pellets with several sheets of thin paper between the filling and the walls of the shell. The top pellet weighing 7 oz. 4 dr. is annular in shape and contained in an aluminium container suitably shaped to fit the forward end of the shell cavity, and fitted with a cardboard closing washer at the base. The remaining five pellets consist of 7 lb. 12 oz. pressed T.N.T. contained in a cardboard carton with a cardboard washer at the forward end and a cardboard disc at the base. The top pellet is annular in shape and surrounds the exploder container and the pellet next below it has a cavity to receive the base end of the exploder container.

The base of the shell is closed by a flanged screwed plug which screws into the shell body. A lead sealing washer fits between a shoulder formed in the shell body below the thread and the flange on the plug.

Labels and stencilling on the bursting charge are as under :—

Label on side of cardboard container—

Zweiteilige Sprengladung fur
15 cm Spgr. L/4,5u. L/4, 6 Kz (m.Hb)
Nr 313D. 5111 u2
3,460 kg Fp 02 — hlu 40
Gefertigt : hlu 40 Lief 2.

Stencilled in circle on side of cardboard container—

Marine Abnahmestelle
(Eagle)
11/9

Label on base of cardboard container—

Zweiteilige Sprengladung fur
15 cm Spgr L/4,5 u. L/4, 6 Kz (m.Hb)
Nr. 313D — 5111
3,46 kg Fp 02 brutto
Gefertigt. hlu 40 Lief 2.

Label on aluminium container holding nose pellet—

Zweiteilige Sprengladung fur
15 cm Spgr L/4, 5 u. L/4, 6 Uz (m.Hb)
Nr 313E — 5111 il
0,211 kg Fp 02 hlu 40
Gefertigt : hlu 40 Lief 2.

GERMAN 15 cm. K. Mrs. Laf. Ctge. Q.F. (Separate)

(Fig. 17)

This is a separate loading Q.F. cartridge and weighs approximately 49 lb. 4 oz. and is fitted with a percussion primer C/12 nA St.

Propellant charge

The propellant charge weighs approximately 29 lb. 3½ oz. and is of the double base type consisting basically of nitrocellulose and diethylene-glycol-dinitrate in tubular form. The sticks are 32·5 inches in length with an external and internal diameter of ·3 inch and ·12 inch respectively.

The propellant bag is stencilled 13,25 kg R.P/38 Bu (825 . 7,5/3). An analysis of this type of propellant averages : nitrocellulose 66·98 per cent., diethylene-glycol-dinitrate 28·87 per cent., akardite 2·84 per cent., graphite 0·21 per cent., sodium sulphate 0·14 per cent. and volatile matter 0·96 per cent.

Details of the igniter composition are not yet available.

Case

The brass case is the normal flanged type 32 inches in length and fitted at the mouth with a brass lid which extends an additional 2 inches to the front. The base of the case is stencilled in black with the weight of the propellant charge and bears the stamping " L/45 ".

Primer

The percussion primer C/12 nA is described in Pamphlet No. 4, page 10. The letters " St " added to the designation indicate that the primer is of steel.

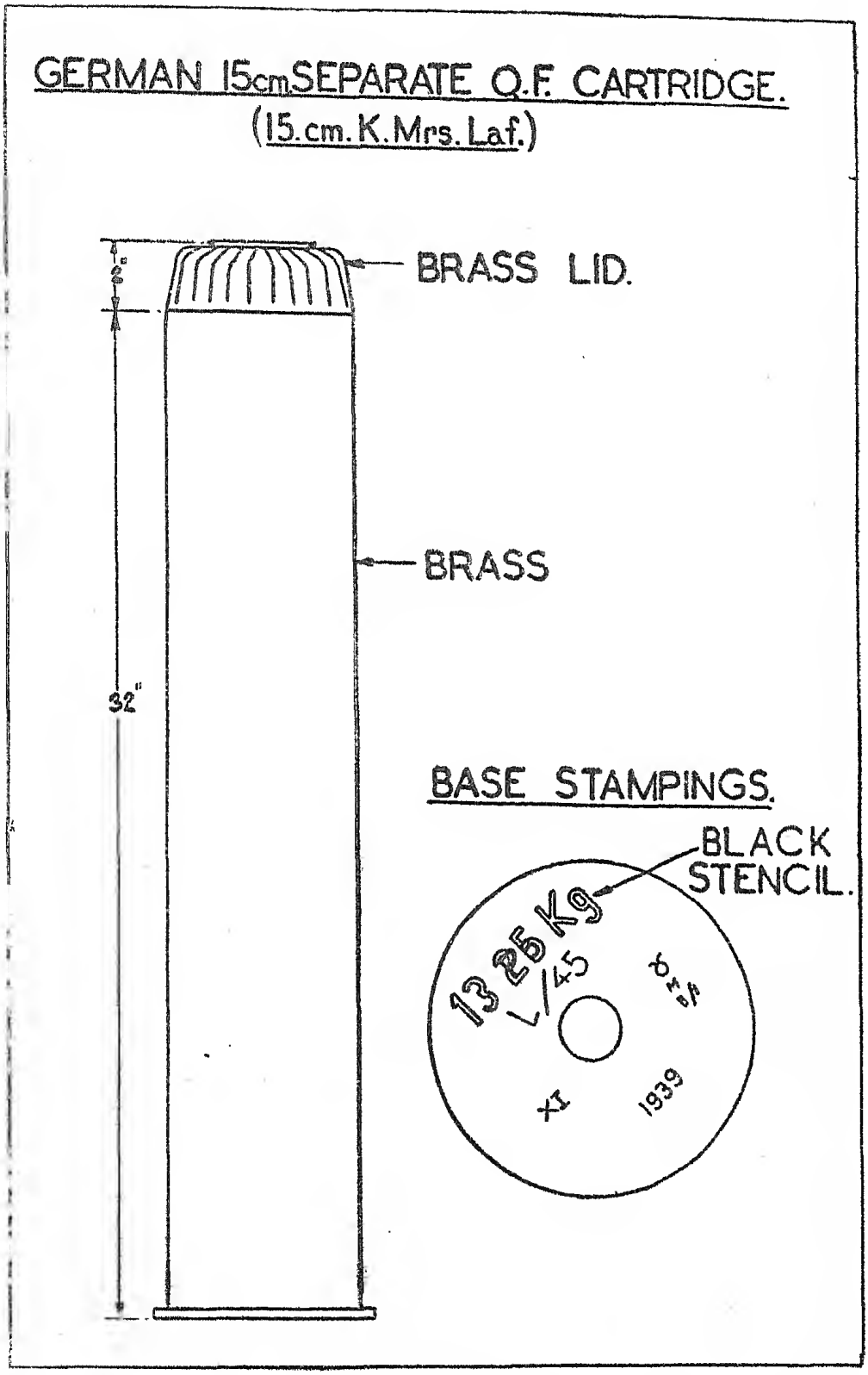

GERMAN 15cm SEPARATE Q.F. CARTRIDGE.
(15.cm.K.Mrs.Laf.)
2"
BRASS LID.
BRASS
32"
BASE STAMPINGS.
BLACK STENCIL.
13 25 Kg
L/45
XI
1939

FIG. 17

TRACER FROM GERMAN 7·62 PAK. 36 APCBC/T SHELL

(Fig. 18)

The tracer weighs 10½ drams and consists of a steel tubular body, brass tubular liner, tracer and priming compositions, steel closing disc, metal foil disc, and a metal washer. The steel components are rust proofed.

The body has an overall length of 0·94 inch and a maximum diameter of 0·59 inch, and is screwthreaded for insertion in the base of fuze Bd.Z.5103*.

The tracer composition is grey in colour and weighs approximately 34 grains. It consists of barium nitrate 63·4 per cent., magnesium metal 31·5 per cent., and resinous matter 5·1 per cent. The composition is pressed with a spigoted drift into the brass liner before insertion in the tracer body from the front.

The front of the tracer is closed by turning the end of the body over the chamfered periphery of the steel disc and sealed by a thin coating of black paint.

The priming composition is grey in colour and weighs approximately 21·6 grains. It consists of barium peroxide 79·3 per cent., magnesium metal 19·5 per cent., barium nitrate 1·2 per cent. The composition is pressed into the body from the rear by a serrated drift after the liner with tracer composition has been inserted. The rear of the tracer is closed by a metal foil disc held by pressing a metal washer into an undercut recess.

TRACER FROM GERMAN 7·62 cm. Pak. 36 APBC/T SHOT WITH TUNGSTEN CARBIDE CORE

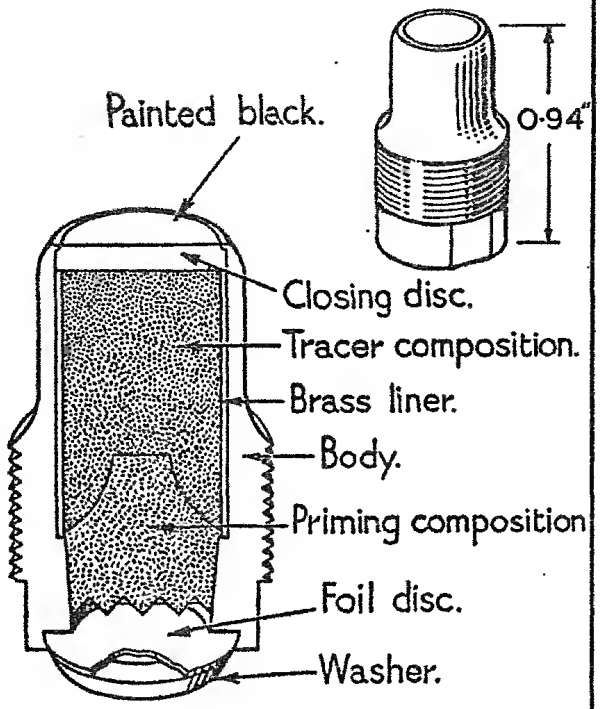
(Fig. 19)

The tracer weighs 3 oz. 5 dr. and consists of a steel tubular body, steel cup shaped liner filled with tracer and priming compositions, steel disc and a celluloid closing disc. All steel components are rust proofed.

The body has an overall length of 1·41 inches and a maximum diameter of 1·02 inches. It is screwthreaded for insertion in the base of the projectile.

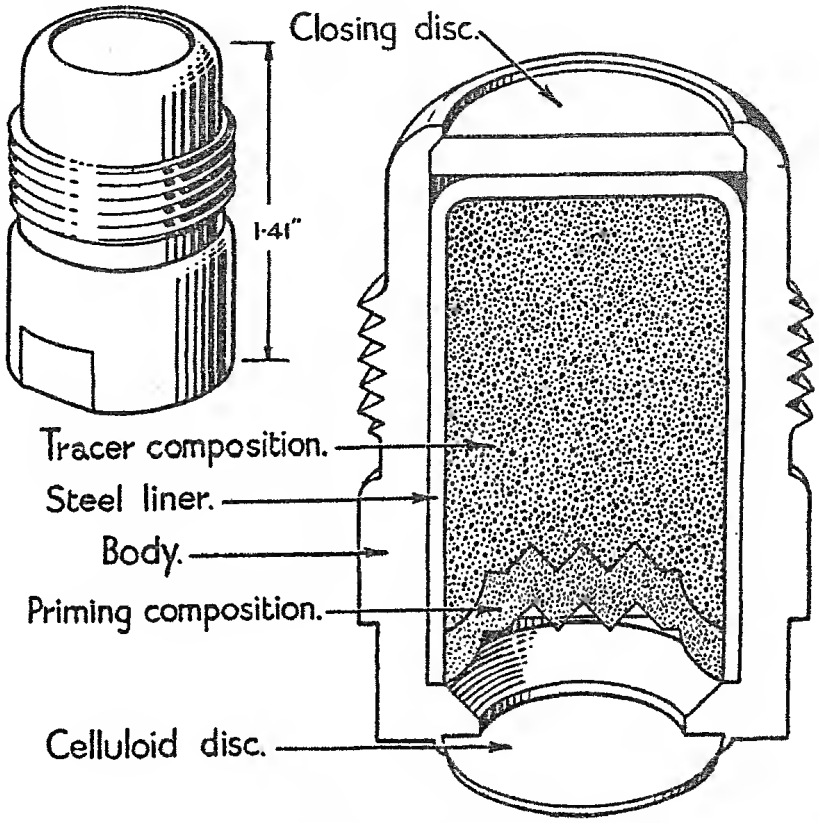
The grey coloured tracer composition weighs 157 grains and consists of barium nitrate 50·4 per cent., magnesium metal 31·1 per cent., sodium oxalate 8 per cent., strontium nitrate 3·5 per cent., and resinous matter 7 per cent. The grey priming composition, with brown substance at one end weighs 37 grains and consists of barium peroxide 76·5 per cent., magnesium metal 13·4 per cent. barium nitrate 4·6 per cent., and resinous matter 5·5 per cent. The tracer and priming compositions are pressed into the liner in separate increments by a convex serrated drift before being inserted in the body from the front.

GERMAN TRACERS.



A.P.C.B.C. SHELL.

FIG. 18



A.P.B.C. SHOT.

FIG. 19

The front of the body is closed by turning its mouth over the chamfered periphery of the steel disc.

The rear of the body is closed by a thin yellow opaque celluloid disc let into an undercut recess.

GERMAN HOLLOW CHARGE ANTI-TANK HAND GRENADE

Panzerwurfmine 1 (L)

Fig. 20

This is a hollow charge anti-tank hand grenade stabilized in flight by four fabric fins. The fins are held close to the handle, but open out immediately the grenade is thrown. The overall length of the grenade is 20·9 inches and its maximum diameter 4·2 inches. The complete grenade weighs 3 lb. 1¼ oz. The grenade body is painted buff colour and stencilled " PWM1 (L) " in black; the handle is unpainted. The top of the fuze cover is stamped " Kappe nicht z Tragen benützen (Do not carry by cap) " and painted red.

The grenade consists of the following principal parts :—

Grenade body filled cyclonite/Wax 50/50.
Wood handle filled PETN/Wax 90/10.
Four fabric fins.
Fuze.
Gaine.

The grenade body is a thin steel cone tapering to a tubular opening 1·18 inches in diameter to receive the end of a wooden handle, whilst the other end is closed by a thin hemispherical outer casing forming the head. The cone and head are secured together by turning the cone opening over a flange in the hemispherical head. The head is strengthened by an inner liner in the form of a thin hemispherical segment cut so that only the outer casing covers the impact area of the head.

The cone portion of the body contains the main bursting charge consisting of approximately 18·5 ozs. of cast cyclonite wax 50/50, and a thin flanged cavity liner. The liner is of pressed steel 0·069 inches thick shaped to form a 30 degree cone 2·4 inches in length, with a base of 1·57 inches which opens into a hemispherical recess 2·8 inches in diameter. The detonative impulse from the fuze is transmitted to the bursting charge through an explosive filling carried in the wooden handle.

The tubular handle is made from beech wood and is approximately 11·75 inches in length ; it contains six pellets of PETN/Wax 90/10, each weighing approximately 7 drams. The end pellets are secured by nitrocellulose varnish and are in contact with the bursting charge and gaine respectively. The forward end of the handle is

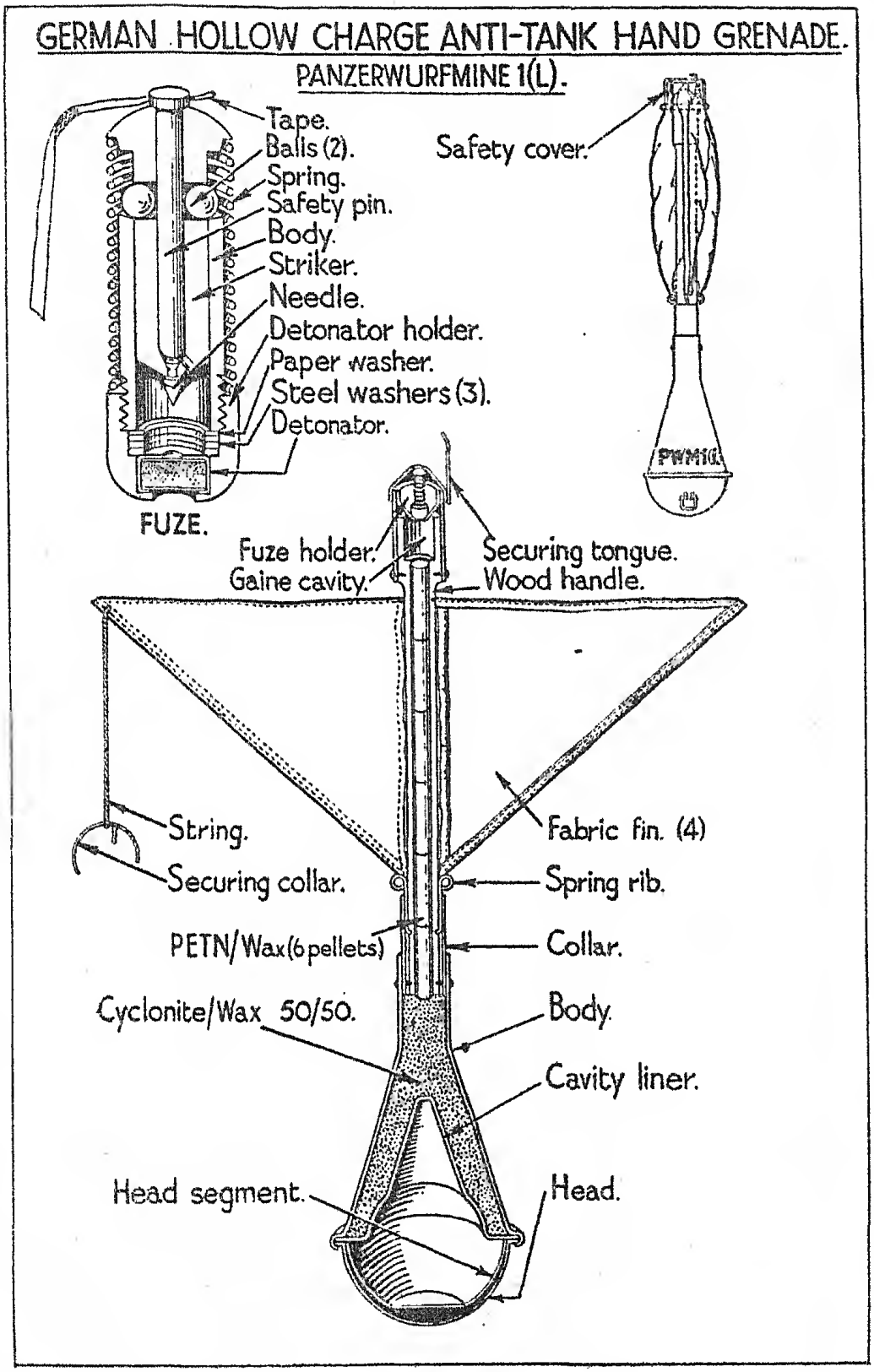

GERMAN HOLLOW CHARGE ANTI-TANK HAND GRENADE.
PANZERWURFMINE 1(L).
Tape.
Balls (2).
Spring.
Safety pin.
Body.
Striker.
Needle.
Detonator holder.
Paper washer.
Steel washers (3).
Detonator.
FUZE.
Safety cover.
PWM1(L)
Fuze holder.
Gaine cavity.
Securing tongue.
Wood handle.
String.
Securing collar.
PETN/Wax (6 pellets)
Cyclonite/Wax 50/50.
Fabric fin. (4)
Spring rib.
Collar.
Body.
Cavity liner.
Head segment.
Head.

FIG. 20

enclosed in a metal collar which fits into the tubular opening at the base of the grenade body ; it is secured by two screws. The rear end of the handle is increased in diameter both internally and externally to form a cavity to accommodate a gaine, and is encased in a metal tube forming part of the fuze holder.

Four steel spring ribs are secured equidistant around the handle, and each carries a triangular stabilizing fin made from textile material. The ends of the ribs are housed in grooves in the forward end of the handle and are secured by the metal collar.

The fins are made of either white or red dyed twill woven viscose rayon and are tacked along the handle opposite its rib. The long edge of the material is turned over the rib and stitched with cotton. A semicircular metal collar fitted with a pin, is attached by a length of string to the free end of one rib. The collar secures the tape of the fuze safety pin and prevents the latter falling out before the grenade is thrown.

The fuze holder consists of a tube with two thin sheet metal cones attached to one end. One is inserted in the tube apex first, and the other closes the end of the tube. The fuze is held longitudinally between the apexes of the cones. Both cones are perforated at their apexes, one to form a flash hole between the fuze detonator and the gaine, and the other for the insertion of the fuze safety pin. A metal tongue attached to the side of the tube secures a safety cover.

The metal safety cover protects the fuze assembly and retains the spring ribs and fins close to the handle during transport. The cover consists of an inner cap inside a larger cap, the former fits closely over the top cone of the fuze holder, and the latter covers the end of the ribs. The inner cap appears to be spot welded to the larger cap. The cover is held by the metal tongue, attached to the fuze holder, which passes through a slit in the top of the cover and is bent over to secure it.

The fuze consists mainly of a body, detonator holder, detonator, striker, safety pin, 2 balls, spring, needle.

The body is a steel tube 0·6 inch long, and accommodates the striker ; it is screwthreaded externally at the forward end for the attachment of a cup shaped non-ferrous detonator holder. The base of the holder is perforated to form a flash hole.

The igniferous detonator is a thin cup-shaped aluminium body 0·24 inch in diameter and 0·12 inch high with a flash hole in the base closed by a thin aluminium disc. It is filled with two compositions, approximately equal in weight and volume. That in the base is a yellow green composition consisting of lead styphnate and barium nitrate 84 per cent., calcium silicide 12 per cent. and organic matter 4 per cent. ; above this is a purple brown composition consisting of lead peroxide 50 per cent. and calcium silicide 50 per cent. The detonator is closed by a tinfoil disc lacquered green, and is inserted upside down in the holder. Above the detonator are three steel washers under a paper washer.

The cylindrical striker is a sliding fit in the fuze body and is provided with a mushroom head and coned end to hold the needle ; it is bored, centrally to receive the safety pin with a length of tape attached and, near the head, radially to accommodate partially two steel safety balls.

The safety pin thrusts the balls outward to foul the fuze body and prevent the forward movement of the striker thereby holding the needle off the detonator. During transport the tape is secured under a metal collar attached by string to one of the spring ribs. When the grenade is thrown, the drag of the tape withdraws the safety pin.

The weak helical spring surrounds the fuze body and is held in compression between a step on the underside of the striker head and the detonator holder.

The short steel needle is provided with a sharp pyramidal point and small shank, it is held in the striker by burring the coned end of the striker around its small shank.

The small PETN gaine (kl Zdlg 34 Np) is used. This was described in Pamphlet No. 11.

Penetration of armour plate

It is estimated that the grenade will penetrate 80 mm. of homogeneous plate (I.T.80) at normal.

Action

The safety cover is removed and immediately the bomb is thrown the fins open out and the metal collar releases the tape of the fuze safety pin. The drag on the tape withdraws the safety pin thereby releasing the two steel balls. The needle is held off the detonator by the striker spring. On impact, the striker compresses the spring and impinges the needle on the detonator. The flash from the detonator detonates the gaine which in turn detonates the filling in the handle and the grenade.

GERMAN 32 cm. INCENDIARY ROCKET

(32 cm. Wurfkörper Flamm)

Fig. 21

This is a self-propelled base venting rocket projectile filled with a mixture of petrol and oil. The venturis are inclined to the axis of the projectile causing rotation and stability in flight. It is fired electrically from either a six-barrel two-wheel mobile projector (28/32 Nebelwerfer 41) or from its own transporting crate which serves as a projector. In the latter case, four crates are laid on a simple wooden ramp (schweres Wurfgerät 40) or a metal ramp (schweres Wurfgerät 41) or six crates are mounted on an armoured personnel carrier (Schwerer Wurfrahmen HO).

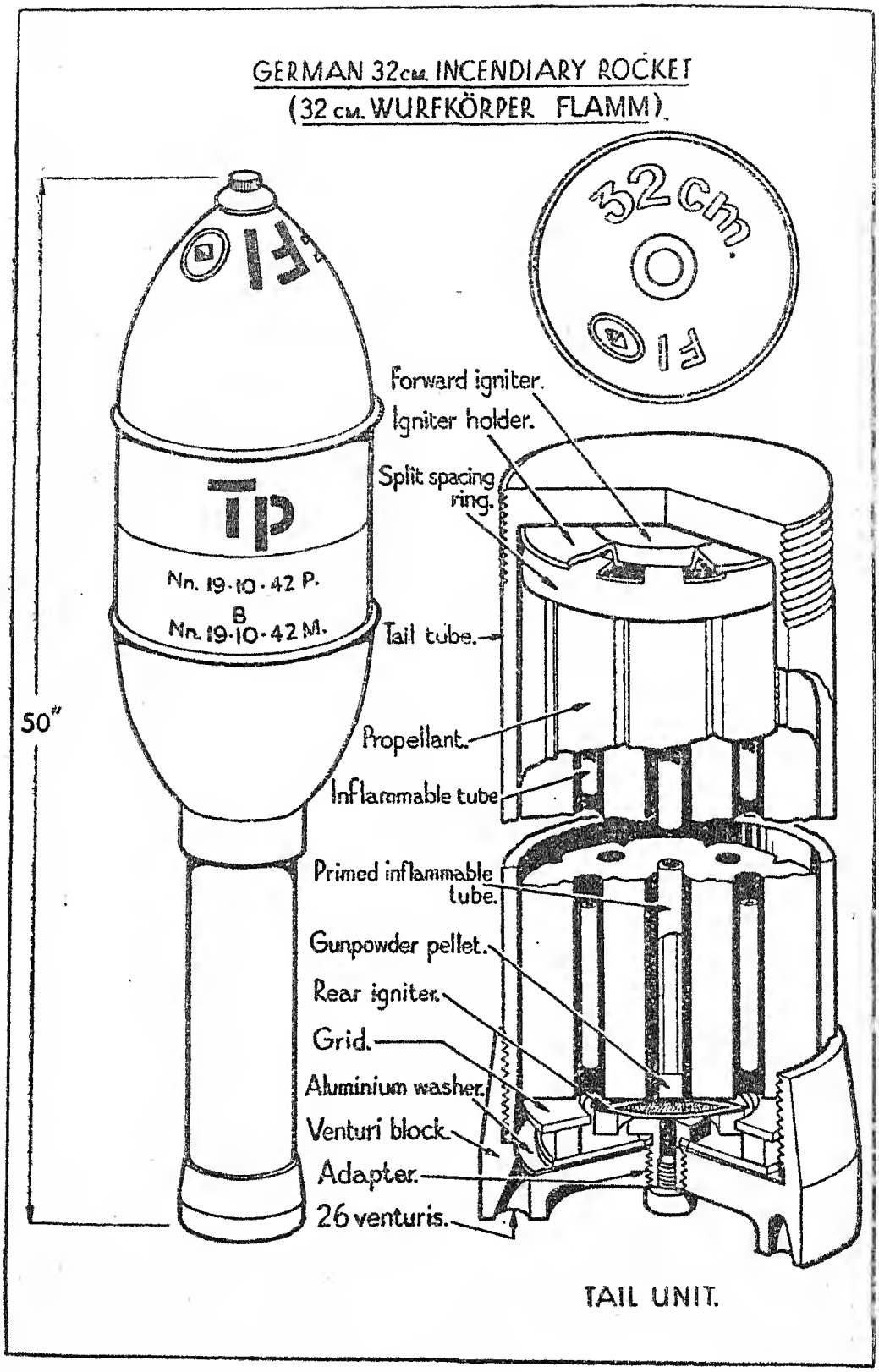

GERMAN 32cm. INCENDIARY ROCKET
(32 cm. WURFKÖRPER FLAMM)
32 cm.
TP
Nn. 19·10·42 P.
B
Nn. 19·10·42 M.
50"
Forward igniter.
Igniter holder.
Split spacing ring.
Tail tube.
Propellant.
Inflammable tube
Primed inflammable tube.
Gunpowder pellet.
Rear igniter.
Grid.
Aluminium washer.
Venturi block
Adapter.
26 venturis.
TAIL UNIT.

FIG. 21

The overall length of the complete round is 4 feet 2 inches and its total weight 174 lb. External markings on the round are shown in Fig. 21. Rounds suitable for hot climates are also stencilled "Tp".

The complete round consists principally of :—

Shell filled petrol/oil mixture.
Bursting charge of penthrite wax.
Incendiary igniter.
Fuze Wgr Z 50 +.
Gaine Gr Zdlg C/98 Np.
Tail unit with propellant charge and ignition system.
Electric ignition fuze.

Boxes containing the following components are issued separately :—

12 fuzes Wgr Z 50 + each in a separate plastic container.
15 gaines packed 5 in a plastic container.
16 single electric ignition fuzes and 4 quadruple fuzes, in a cardboard box.

Shell

The overall length of the shell is 31·6 inches and its diameter 12·8 inches. The empty body weighs 13 lb. 12½ oz. and is of thin sheet steel 0·07 inches thick; it is welded circumferentially at about its centre. Two circumferential ribs are also formed in the body, one below the head and the other above the streamlined base. The head is shaped to a low crh and prepared to receive a plastic adapter which incorporates a gaine container. Near the nose is a charging hole closed by a plug. The base is streamlined and terminates in a short cylindrical tube which is screwthreaded internally to receive the tail tube.

The incendiary filling is a brown liquid consisting of 11¼ gallons of petrol/oil mixture.

The bursting charge consists of a cylinder of penthrite wax surrounding the gaine container.

The incendiary igniter is contained in a soldered tin sheet cylinder, 24·1 inches long, placed axially in the shell with one end butting against the base of the gaine container.

Fuze and gaine

The fuze used is one of the Wgr Z 50 + type referred to elsewhere in this pamphlet.

The gaine is the large size C/98 Np described in Pamphlet No. 6, page 14.

Tail unit (Fig. 21)

The tail unit has an overall length of 19·9 inches and weighs approximately 49 lb. 8 oz. filled. It consists of the following principal components : tail tube, venturi block, propellant charge,

a grid, spacing ring and an ignition system. Typical stencilling on the tail tube and venturi block is shown in Fig. 21. The internal metal parts are not rust proofed.

The steel cylindrical tail tube weighs 23 lb. 14 oz. and appears to be a solid forging machined inside and out to a diameter of 5·5 inches and 5·05 inches respectively, and internally to a depth of 18 inches; it is closed at the forward end and screwthreaded externally for insertion in the base of the bomb body. The venturi end has a coned opening screwthreaded externally to receive the venturi block.

The solid venturi block weighing 9 lb. 6¾ oz. is cup-shaped to an overall depth of 3 inches and an internal depth of 1·75 inches; it is screwthreaded internally for attachment to the tube. Externally, it is chamfered towards the top. Twenty-six venturis, equally spaced, are formed in the base near the periphery; each has a throat diameter of approximately 0·22 inch and the cones are inclined at 14 degrees to rotate and stabilize the rocket in flight. The venturis of rockets suitable for hot climates are sealed on the outside by a "soldered on" flat tinned iron ring which blows off on ignition. The area of the base surrounded by the ring of venturis is recessed to a depth of 0·1 inch, also bored centrally and screwthreaded to receive an adapter screwed in from the inside. The base is stamped "DOVT 15 WU 26 × 5.5 ⌀ 14°, all 8c, 41." The stamping includes characteristics of the venturi, *i.e.*, the number, throat diameter and inclination.

The propellant charge, weighing 14 lb. 6¾ oz. is a single multi-perforated stick of double base propellant of the Digl type, having eight longitudinal "V" section channels formed in its exterior when extruded from press. The propellant of the round examined consisted of nitrocellulose 62·5 per cent., diethylene-glycol-dinitrate 33·6 per cent., volatile matter 0·6 per cent., stabilizer (probably akardite) 0·6 per cent., graphite 0·12 per cent., ash (carbonated) 0·75 per cent. and error and undetermined matter 2·43 per cent. The stick is 16·27 inches long and 4·79 inches in diameter, with a central perforation, star shaped in section, surrounded by eight circular perforations equally spaced on a circle 2·6 inches in diameter. The tropical propellant is marked "Dgp. DOP. 15 Wu (Digl. Ngl.) Tp. dbg 142/2" and the non-tropical "DO. Wu. P.15 (Digl) dbg 1942. 12". The base of the propellant is supported by a grid.

The grid consists of an annular ring $\frac{3}{16}$ inch thick, $4\frac{3}{8}$ inches external and $3\frac{1}{8}$ inches internal diameter, supported by six small cylindrical distance pieces $\frac{1}{2}$ inch in diameter and $\frac{3}{8}$ inch high from a flat plate $\frac{1}{16}$ inch thick and $4\frac{3}{8}$ inches in diameter. The grid is bolted to the front face of the venturi block by the adapter.

The adapter is a cylindrical tube with a hexagon flange formed at one end. The stem portion is screwthreaded externally for insertion in the block and internally to receive the electric ignition fuze. The adapter is inserted from the front; for transportation it is closed by a screwed plug.

Between the grid and the block is a thin aluminium washer which closes the venturis.

The free space at the forward end of the propellant is taken up by a split spacing ring with ten pairs of lugs bent inwards to form a "U" shape in section.

The ignition system consists of a forward and rear igniter, eight inflammable tubes in the channels round the exterior of the propellant stick and one primed inflammable tube in the centre perforation, and an electric ignition fuze.

The forward igniter consists of a pressed pellet of gunpowder with a perforated strip of nitrocellulose across its face, in a flat circular aluminium container. The igniter is held in a holder in the form of a washer fitting in the head of the tube with its inner edge turned over to hold the igniter centrally within the spacing ring. The open side of the igniter faces the propellant stick.

The rear igniter consists of a flat rough circular bag containing 10 grains of igniter composition in the form of six pointed star-shaped flakes; it is housed centrally between the base of the propellant and the adapter. The bag is marked Nz.Man.St. P (2 . 55/23) dt 1938/5. WO. 7.8.42 W.

The inflammable tubes found in the "V" channels in the side of the stick are slightly shorter than those in the central hole and are not primed. The tube in the central hole contains what appears to be quickmatch and each end is closed by a gunpowder pellet. The forward end is housed centrally within the forward grid opposite the forward igniter. The rear end is in contact with the rear igniter.

The electric ignition fuze, enclosed in an aluminium tube and bakelite container, is screwed into the central hole of the adapter. It may be fired from a 4-volt battery. Rounds may be fired singly. For firing from the Wurfgerät, four ignition fuzes, externally similar in appearance, are wired in series. One only, tagged "O", is instantaneous, the remainder, tagged "2", "4" and "6" respectively include powder pellets so as to fire at intervals of 2 seconds.

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